

FOREST FLORA OF SRINAGAR

AND
Plants of Neighbourhood

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with a chapter on

ETHNOBOTANY OF KASHMIRIS
by Prof. P. Kachroo and Mrs. Iqbal Mahmuda Nahvi

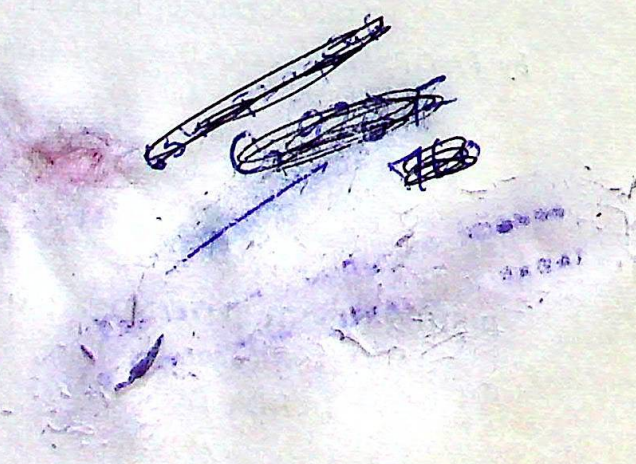
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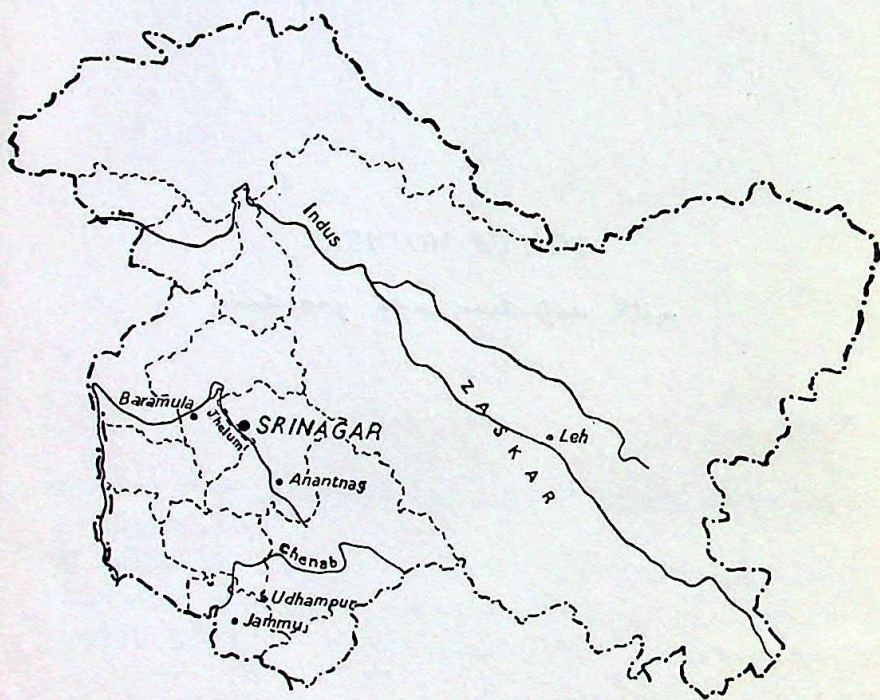
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TO OUR MOTHERS

with affection and gratitude



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MAP OF JAMMU AND KASHMIR STATE

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PREFACE

In 1967, I started a comprehensive project on study of the flora of Jammu and Kashmir State from taxonomic and ecological points of view. Except for the 'classical' literature, little information on detailed taxonomy of our plants was known; notwithstanding Stewart's listing in his 'Flora of West Pakistan'.

To begin with, I envisaged these studies as Ph.D. projects and G.N. Javeid studied taxonomically plants of Srinagar and B.M. Sharma those of Jammu. This was followed by "Floristic composition of Harwan Woodland, a phytosociological study" by Gurcharan Singh; and a monographic treatise on grasses, sedges and rushes of Kashmir Valley by B. Misri, who worked out in detail the tribe Agrostideae (Gramineae) for his Ph.D. At present another student (U. Dhar) is engaged on taxonomic and phytogeographic studies on subalpine and alpine flora of Kashmir. Study on temperate-alpine flora in relation to ecological management and as part of forest ecosystem studies is being initiated shortly in the Doodganga Catchment area of the Valley.

In the meantime in 1973 due to dynamic cooperation of Shri G. Naqushband, Chief Conservator of Forests, J. & K. State, and his appreciation for such studies, the Govt. of Jammu and Kashmir (through his Department) sanctioned a project on flora of the State. Under this project we have nearly surveyed the whole Valley, and decided to release in parts work on the flora, whether financed by the Govt. or otherwise. The present book is the first in the series.

I am thankful to the University Grants Commission, the Council of Scientific and Industrial Research, the Indian Council of Agricultural Research, and the Department of Forests, J & K State, for financial support provided to my scholars in form of fellowships or travel grants during the period they were associated with these studies.

Dr. Gurcharan Singh and self are thankful to Late Dr. N.L. Bor (Kew Herb.), Dr. Heslop-Harrison (Director Kew B.G.), Sir George Taylor (ex Director, Kew B.G.), Dr. G.M. Oza

(Baroda), Dr. R. Barneby (Curator, N.Y.B.G.), Mr. K.C. Sahni (F.R.I.), Prof. E. Ehrendorfer (Bot. Instt. und Botan. Garten der Univ. Wein), Mr. J. B. Gillet (East African Herb., Nairobi) for their comments regarding the identity of certain taxa of plants.

Thanks are due to Game Warden (Srinagar) for permitting us to work in the sanctuary, Dr. A.K. Skvortsov (Director, Main Bot. Garden, Moscow) for latin diagnoses, and Dr. Mrs. Proskuriakova (Main B.G., Moscow) for lending some specimens for comparison.

The arrangement of families in the enumerative part of this book is after Hutchinson (1959).

For the long list of errata both the authors and the publishers are responsible; reason: haste!

Srinagar

June 1, 1976

Professor P. Kachroo

FOREWORD

In a modern sense, it was in the 17th to 19th centuries that a knowledge of the flora of Subcontinent of India began with great efforts of a few European naturalists; and in the first half of the 19th century were completed the "Flora of British India" by J. D. Hooker and associates, and a few provincial floras. A review of work on taxonomy and floristics of various parts of the country has been given by Rev. H. Santapau in the "History of Botanical Researches in India, Burma and Ceylon" in 1958.

With respect to Jammu and Kashmir State, however, J. F. Royle was the first serious worker. He sent collectors to the State and published the "Illustrations of the Botany and other Branches of Natural History of the Himalayan mountains and Flora of Cashmere". From 1900 to 1958 were published two important books which do not claim strict taxonomic status. These are B. O. Coventry's "Wild Flowers of Kashmir"; E. Blatters's "Beautiful Flowers of Kashmir" and W.J. Lambert's "List of Trees and Shrubs for the Kashmir and Jammu circles". To these may be added R. R. Stewart's paper on Flora of Western Tibet and his "Flora of West Pakistan". From 1958 to 1967 no serious taxonomic work on this area has been undertaken either in the country or by a foreigner, whereas notable works of floras of other parts of the country have been published.

In view of this deep lacuna in our knowledge of plants of the State, it was indeed appreciative on the part of Professor P. Kachroo to initiate comprehensive and dedicated investigations on flora of this State in his Department at the University of Kashmir. The fact that plants are the intrinsic part of the forest ecosystem, my Department became a willing partner in this national task of surveying the plant resources of this State and agreed to finance the project under his supervision and guidance.

I am glad to say that the work on the Flora of Jammu and Kashmir State by his team of workers and colleagues is progressing well. The present Flora is the first in the series planned

on Kashmir Valley. Considerable labour has gone into preparation of this book and I am sure it will prove useful equally to a botanist and a forester. The next floras to be printed are those on Ladakh and on Jammu and its neighbourhood.

Srinagar
May 3, 1976

G. NAQUSHBAND
Chief Conservator of Forests
J.& K. Government

INTRODUCTORY

The State of Jammu and Kashmir is situated in the north of India and has an area of 138992.1 sq km (north to south 640 km, east to west 480 km). The state is highly mountainous except for a short belt adjoining the Punjab plains and the valley of Kashmir. However, it is distinctly divided into three geographic units: Jammu, Kashmir, and Ladakh. It lies between $32^{\circ}.17' N$ to $36^{\circ}.58' N$ latitude and $73^{\circ}.26' E$ to $80^{\circ}.30' E$ longitude. Kashmir valley occupies 15120.3 sq km and the total area, its classification and composition of forests is given in Tables 1 and 2.

The stratified rock formations have resulted in a broad division of three main structural groups in the entire state, namely: the Panjal, the Zaskar, and the Tertiary groups. The Panjal includes the outer hills, outer plains and the middle mountains; the Zaskar the whole of the eastern region from Spiti to Lahul to the lofty Korakoram in the north, and the Tertiary group the valley of Kashmir and other river valleys.

CLIMATE

A great physiographic and climatic variation is observed in the State and this is clearly reflected in its three constituents in their geology, seasonal variation, soil, and vegetation. In fact, the climate varies in accordance with the altitude which results in marked differences in wind, atmospheric pressure, and rainfall, thus forming a clear climatic index. The valley experiences an irregular climate with large inter yearly variations in the amount of precipitation, length of dry period and seasons of its occurrence. Precipitation in form of snow is much greater on higher altitudes. Notwithstanding minor climatic changes in smaller valleys and sub-valleys, the average climate is sub-Mediterranean with bixeric regime having two spells of dryness, one in June and another in September to November, and high precipitation during cool seasons: though typical Mediterranean, trixeric and quadrixeric types are also met with over different years.

The Ladakh region is a cold desert and two distinct bioclimates are recognized: the cold and the cold temperate.

Table 1. Total area and its classification in Kashmir (in, 000 acres).

Districts	Total area	Forests	Land not available for cultivation	Other uncultivated land	Fallow land	Cropped area
Anantnag	537	3	106	84	326	315
Srinagar	314	5	59	51	192	201
Baramulla	523	4	89	85	322	329
Total Kashmir	1374	12	254	220	840	895

Table 2. Area under forests by composition in Kashmir (in sq miles).

Forest Division	deodar	Commercial kail	fir	chir	Mixed broad leaved	wooded alpine	Uncommercial unwooded blanks
Kamraj	70.13	68.48	66.88	...	4.11	51.90	90.04
Langat	51.93	38.74	76.49	...	0.39	37.39	46.38
Sind	3.90	80.00	127.70	...	21.10	...	556.70
Gurez range	...	5.84	10.35	...	0.25	41.74	37.36
Jhelum valley	36.50	24.00	43.70	361.14	18.36
Pir Panjal	3.63	50.59	127.48	25.17	4.04	16.12	289.37
Kashmir	10.60	121.60	86.90	...	2.130	446.30	20.00
Plantation	...	15.45	10.40	...	28.51	...	32.37

Table 3. Average rainfall at Srinagar

	Jan	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Average rainfall (mm)	74	72	92	93	60	36	59	61	39	30	11	34
	Total. 661											

Table 4. Atmospheric temperature at Srinagar

Month	Mean (°C)	Maximum (°C)	Minimum (°C)
January	1.2	5.0	2.6
February	2.7	6.7	1.4
March	8.3	13.8	2.8
April	12.9	18.8	7.0
May	17.6	25.0	10.2
June	21.9	29.7	11.8
July	24.5	31.0	17.9
August	23.9	30.3	17.4
September	20.3	28.6	11.9
October	14.0	23.2	4.8
November	8.5	16.9	0.1
December	3.3	9.0	2.4

COLLECTORS

The first record of collection in the State is that in 1822 by William Moorcroft who with G. Trebeck in 1841 wrote *Travels in the Himalayan Provinces of Hindustan*. In 1833-39 John Forbes Royle published *Flora of Kashmir* (with illustrations). Victor Jacquemont's collection was later used by Joseph Decaisne in 1845. Other notable collectors were Godfrey Vigne (1836), von Huegel (1835), Hugh Falconer (1839), James Edward Winterbottom (1846), Thomas Thomson (1878), C. B. Clarke (1876), John Firminger Duthie (1892-93), Hansley W. Botting (1892), B. Sahni and G. S. Puri (1948).

fossils). However, the account of plants of the State known till then is only available in J. D. Hooker's (1875) *Flora of British India*. Blatter's *Beautiful Flowers of Kashmir* and Coventry's *Wild Flowers of Kashmir* need also be mentioned. Recent collectors have been R. R. Stewart (1925-1947), T. A. Rao (1960), L. D. Kapoor (1966), staff of Botany Department, Kashmir University; B. M. Sharma, Y. K. Sarin, and Harvinder Kiran from Jammu, 1968 onwards. Gurcharan Singh has collected and travelled most in the Valley.

GEOBOTANY

At one time the whole valley was covered with karewa deposits of a vast lake (for history see Sahni, 1936). The shrinking remnants of this lake are the present lakes of the Dal, Mansbal, Wular, etc. It was flanked on the north by the slopes of the main Himalayas and on the south by what is now Pir Panjal Range. The latter separated the lake basin from the Indian plains (de Terra, 1936). The karewas lie at present in isolated blocks and at depths below 300 m show plant remains of Pleistocene age as well as lower down 'varves', a characteristic feature of glacial regions. Wadia (1932) stated that it was during final phase of uplift of the Himalayas that the karewa beds were dragged up 2,000 m on the Pir Panjal Range and caused tilting of the late Pleistocene lake terraces round Srinagar, the effect of this upheaval was as far west as the Salt Range. It is now established that as in Europe during the Ice Age the valley experienced several periods of extreme cold alternating with warm periods culminating in the present temperate flora of the Kashmir valley.

The fossils of Pir Panjal Range (de Terra in Wodehouse, 1935) are forest trees, shrubs, such as oak, willow, poplar, elder, box, berberry, rose, *Rhododendron*, cinnaom, holley, and *Trapa*, *Vallisneria*, *Chara*, etc. The Pir Panjal Range together with the Himalayas was once under the Mediterranean Ocean, the Tethys, separating India (which lay south of equator) from the Eurasian land mass in the north. Into this sea India sent out two great promontories: the Kashmir promontory on the northwest and the Assam promontory

on the northeast (Mitra, 1927). Wadia (1936) stated that Kashmir was connected with Eurasia by an isthmus!

It may be recalled here that the region on the southern side of the Tethys was represented by *Glossopteris* flora and the region north of it by *Gangomopteris* flora. But the former, at the end of glacial period, did not represent "a glacial flora like the modern flora of arctic regions" (Sahni, 1937). Sahni (1939) believed that *Glossopteris* flora did not originate in a tropical climate. He further stated (1921) that most of the Indian fossil plants belong to the Gondwana system, extending up to Kashmir. It is possible that in this northern maritime province of Gondwanaland, the vegetation was somewhat different from that in the interior of the continent".

The *Glossopteris* flora did not have much in common with *Gigantopteris* flora, though there was an intermingling of the two in the Far East, the former was essentially southern and temperate and the latter northern in warmer climate analogous to that of the European coal measures. The two, however, evolved on separate continents though some means of some intermigration was possible in the later phases. As regards Gondwanaland element in Angaraland, it may have crossed by way of a late Palaeozoic archipelago which Zelessky had postulated (Sahni, 1918). Geological evidence of such an archipelago has since been found by Wadia in the Kashmir portion of the Tethys. A consideration of flora of Kashmir thus assumes importance.

Recently Robert (1969-70) has found that quite a few species of eastern Himalayas flourished in Kashmir valley during the first interglacial and their absence now is alleged to be the result of physiographical changes since the desposition of lower karewas. Further the composition of the interglacial forests was much different from that of comparable forests of today in the valley. Thus, during the successive stages in the phytogeographical evolution of Kashmir valley since early quaternary as a result of repeated alternation in cooling and warming of climate in pleistocene together with a cycle of organic movements, the original vegetation in the valley was transformed from a subtropical

one of a typical oak-laurel community to the present temperate pine-deodar-silver fir-cherry-horsechestnut community. In this process of trial through geological times, the oak-laurel-chir communities were eliminated.

Floristics: Floristically the state of Jammu and Kashmir is divided into three regions: alpine desert flora of Ladakh, subtropical flora of Jammu, and predominantly temperate flora of Kashmir. General features of the three are summarised below :

Ladakh: This high altitude desertland with practically no rainfall during growth period is largely dominated by xerophytic vegetation. The natural tree elements being largely lacking except for more humid regions of Nubra valleys and river valleys in the whole district. *Hippophae* scrub, *Caragana pygmaea* are the major woody components together with *Acantholimon lycopodioides*, the major source of roofing and fuel wood. The region supports several characteristic species endemic to this area of the world e.g., *Stachys tibetica*, *Euphorbia tibetica*, *Astragalus falconeri*, *Christolea crassifolia*, etc. The major families of flowering plants in the area include Compositae, Papilionaceae, Cruciferae, Labiatae. *Astragalus*, *Artemisia*, *Polygonum* are the major genera of flowering plants.

Kashmir: With predominantly temperate climate and extending from near 1,350 m to the upper altitudinal level of the plant life, shows zonations of (a) mixed vegetation of broad leaved deciduous trees and conifers (b) conifer forest zone and (c) white birch zone dominated by perennial herbs; but numerous annual weeds have found access to the lower regions of valleys through European travels. The localised distribution of *Conium maculatum*, *Senecio vulgaris*, *Cymbalaria muralis*, etc. in and around Srinagar owe their recent introduction in the valley. The higher slopes of the valley however support several endemic species including *Pseudostellaria kashmiriana*, *Veronica stewartii*, *Phlomis kashmiriana*, *Lavatera kashmiriana*. The major families of flowering plants are Compositae, Gramineae, Labiatae, Rosaceae, Papilionaceae, Cruciferae. The major

genera are *Saussurea*, *Potentilla*, *Polygonum*, *Artemisia*, *Lactuca*, *Ranunculus*, *Senecio*, *Poa* and *Bromus*.

Jammu; The subtropical belt of Jammu province is largely dominated by broad leaved woody elements, both deciduous and evergreen types being well represented. The inner ranges towards Kashmir have deodar and chir pine forests. Papilionaceae, Gramineae, Compositae, Cyperaceae, Scrophulariaceae, Labiatae, etc. are the major families in the area. On the dry hillocks are found *Acacia medesta*, *Bauhinia variegata*, *Launea coromandelica*, etc. The foothills are dominated by *Dodonaea* scrub, *Dalbergia sissoo*, *Adhatoda* scrub, etc. Unlike the temperate Kashmir, woody genera are among the major ones in the area. These include *Desmodium*, *Indigofera*, *Cassia*, *Acacia*, etc. The major herbaceous genera in Jammu include *Polygonum*, *Ranunculus* and *Cyperus*.

On the basis of photointerpretation surveys of M. S. Tomar the state forests area has been divided into two catchments, namely, Kashmir valley and Chenab Valley, each having four forest divisions (excluding Ladakh). The former is delimited into six vegetational zones: fir, deodar, blue pine, chir pine, broad leaved, and scrub. But this zonation is arbitrary being based on preponderance of a particular plant species in the area which is not supported by any phytosociological study. G. Naqushband on the basis of type and function of forests classifies the vegetation of the state into four main types: dry tropical forests, mountain subtropical forests, mountain temperate forests, and alpine scrub and Ladakh as a cold desert. The forests of Kashmir valley he includes in mountain temperate forest type and subdivides it into: fir-kail forests of Pir Panjal Range and Sind valley; deodar-kail forests of Kamraj, Langet, and parts of Kihuhama; and deodar-kail forests of Buniyar Kathia and Baramulla Ranges.

The present vegetational complex of high forests and their vertical and lateral composition pose many a question and A. N. Fotedar feels this more so with reference to tem-

poral and spatial distribution of *Cedrus deodara*. The normal range of this species in the Himalayas (including Chenab valleys) is that it is found in between the upper altitudinal limits of *Pinus roxburghii**, being associated with *Quercus incana*, and the lower limits of fir forests and associated with *Quercus semicarpifolia*. This intermediate altitudinal zone occupied by deodar lies between 1,900 m to 2,900 m and here the associate is *Quercus dilatata*. The distribution of deodar does not follow this pattern east of Pir Panjal range. In Kashmir valley deodar grows from 1,800-2,900 m. excepting in Pir Panjal where it is absent; save in some localised areas such as Yarwan and some toes of Karewas. Interestingly in spatial distribution deodar is again variable, e.g., on cooler and moister aspects it is replaced mostly by fir and on the drier and hotter aspects by *Pinus wallichiana*.

In Kashmir, the proportion of Dicotyledons, Monocotyledons and Gymnosperms is as follows:

	Genera	Species
Dicotyledons	556	2400
Monocotyledons	178	515
Gymnosperms	7	31

On the basis of extant records 2928 species belonging 741 genera are represented in the valley. Of these 44 families are represented by a single genus in Kashmir, and their distribution is interesting. The 30 important ones are illustrated in Table 5. The others include Trapaceae (*Trapa*), Datisceae (*Datisca*), Linaceae (*Linum*), Pyrolaceae (*Pyrola*), Punicaceae (*Punica*), Budlejaceae (*Budleja*), Parnassiaceae (*Parnassia*), Adoxaceae (*Adoxa*), Selaginaceae (*Lagotis*), Paeoniaceae (*Paeonia*), Phytolacaceae (*Phytolaca*), Butomaceae (*Butomus*), Zannichelliaceae (*Zannichellia*), Najadaceae (*Najas*).

* *Pinus roxburghii* forests are core of subtropical pine forests. In the J. and K. state, they occur in the lower Chenab valley and the low lying tracks of the Siwaliks at an altitude of 500-1800 m; sometimes extending to 2,400 m. In Jammu, these forests cover Ramban, Reasi, Udhampur, Billawar, Rajouri, and Poonch.

Table 5. Distribution of families represented by a single genus in Kashmir

Family	Total genera	Genera in India	Genera in Kashmir	Total species in India	Species in Kashmir	Distribution of family	Distribution of genus	Distribution of species found in Dachigam R, restricted; W, widely distributed
1	2	3	4	5	6	7	8	9
Grossulariaceae	1	1	<i>Ribes</i>	8	5	Tem. N. Hem.	Same	<i>R. glaciale</i> : W. Bhutan to Kashmir
Platanaceae	1	1	<i>Platanus</i>	1	1	Tem. & Subtrop.	Same	<i>P. orientalis</i> : W, Kashmir, N. W. Himalayas, N. Persia to Italy elsewhere.
Hamamelidaceae	23	8	<i>Parrotiopsis</i>	8	1	Asia, Africa, N. America	Himalayas	<i>P. jacquemontiana</i> : R, W. Himalayas, mainly Kashmir.
Corylaceae	4	2	<i>Corylus</i>	4	1	N. Temp. zone	Same	<i>C. colurna</i> : W, Kashmir to Kumaon, Asia minor, Hungary.
Juglandaceae	7	2	<i>Juglans</i>	8	2	N. Temp. & Trop. Hemisphere	N. Temp. Hem., W. Indies	<i>J. regia</i> : W, Temp. Himalayas, Persia, Caucasus, Europe, etc.
Violaceae	16	3	<i>Viola</i>	19	16	Temp. & Troop. regions	-Temperate regions	<i>V. biflora</i> : W, Kashmir to Sikkim.

1	2	3	4	5	6	7	8	9
Polygalaceae	10	5	<i>Polygala</i>	16	7	Warm regions	Widespread except Tasmania	<i>V. serpens</i> : R, Temp. Himalayas, Nilgiri. <i>V. odorata</i> : W, Kashmir, Hazara, Chitral. <i>V. saloneri</i> R, Kashmir, only. <i>V. sylvatica</i> : W, Kashmir, Hazara. <i>V. patinii</i> : W, Temp. Himalayas, N. Asia, China, Japan, Russia.
Hypericaceae	8	3	<i>Hypericum</i>	26	6	Temp and warm regions	Temp. regions	<i>P. sibirica</i> : W. Temp. and Subtropical Himalayas, China, Japan, Siberia.
Celastraceae	45	13	<i>Euonymus</i>	110	4	Temp. & Trop. regions	Mainly Trop. Asia	<i>H. perforatum</i> : W. Temp. W. Himalayas, Europe, N. Africa, N.W. Asia.
Simaroubaceae	32	9	<i>Ailanthus</i>	16	1	Pantropical	India, China, Australia	<i>E. hamiltonianus</i> : R, outer Himalayas in Kurum, Murree, Kashmir. <i>E. finbriatus</i> : W, Kashmir, Kumaon, Chitral etc. in Himalayas.
Aceraceae	2	1	<i>Acer</i>	13	6	Temp. N. Hem.	Mountains of N. Hemisphere	<i>A. altissima</i> : W. N. India, China, etc. <i>A. caesium</i> : R, Kashmir to Nepal.

1	2	3	4	5	6	7	8	9
Hippocastanaceae	2	1	<i>Aculus</i>	2	1	Temp. N. Hem.	America, Europe, Asia	<i>A. cappadocicum</i> : W, Kashmir to Bhutan, Afghanistan, Persia, etc.
Staphyleaceae	6	2	<i>Staphylea</i>	2	1	Temp. N. Hem.	Same	<i>A. indica</i> : R, W. Himalayas, Afghanistan.
Verbenaceae	98	23	<i>Verbena</i>	150	1	Trop. & Subtrop. regions	Chiefly America	<i>S. emodi</i> : R. W. Himalayas, Afghanistan.
Berberidaceae	2	2	<i>Berberis</i>	70	16	N. Temp. zone, America	Primarily Asiatic	<i>V. officinalis</i> : W, Himalayas, Temp. & Trop. regions of world.
								<i>B. psuedobellata</i> : R, Kashmir.
								<i>B. pachyacantha</i> : R, Kashmir.
								<i>B. lycium</i> : W, Kashmir to Nepal.
								<i>B. huegeliana</i> : R, Kashmir.
Portulacaceae	16	2	<i>Portulaca</i>	6	1	Mainly America	Same	<i>P. oleracea</i> : W, India, all warm regions of world.
Illecebraceae	17	2	<i>Herniaria</i>	3	2	Dry arid regions	Europe, Africa	<i>H. cashemiriana</i> : R, Kashmir, Hazara, Swat.
Callitrichaceae	1	1	<i>Callitriche</i>	2	2	Cosmopoliton	Cosmopoliton	<i>C. stagnalis</i> : W, Himalayas, Deccan, Ceylone, Asia, Europe, etc.

1	2	3	4	5	6	7	8	9
Plantaginaceae	3	1	<i>Plantago</i>	13	8	Widely distributed	Widely distributed	<i>P. major</i> : W, Himalayas, Ceylone, Asia, Europe, etc. <i>P. lanceolata</i> , W, Himalayas, Europe, N. Asia. <i>P. depressa</i> : R, Himalayas. <i>P. himalaica</i> : R, W. Himalayas, Afghanistan. <i>U. aurea</i> : W, throughout India, S. E. Asia, Malaya, Australia, etc. <i>O. coriiculata</i> : W, throughout India, Cosmopolitan. <i>I. bicolor</i> : R, W. Temp. Himalayas. <i>I. gigantea</i> : W, Temp. Himalayas. <i>I. edgeworthii</i> : R, W. Temp. Himalayas. <i>I. thomsonii</i> : W, Himalayas from Sikkim to Kunawar. <i>I. glandulifera</i> : R, W. Himalayas. <i>I. brachycentra</i> : W, Himalayas, Soongaria. <i>I. cristata</i> : W, Himalayas.
Lentibulariaceae	5	2	<i>Utricularia</i>	32	3	Temp. & Trop. regions	Same	
Oxalidaceae	4	2	<i>Oxalis</i>	14	3	Trop. & Subtrop. regions	Chiefly Africa & America	
Balsaminaceae	2	2	<i>Impatiens</i>	140	16	Mainly Asia and Afric	Same	

1	2	3	4	5	6	7	8	9
Cuscutaceae	1	1	<i>Cuscuta</i>	13	9	Widely distributed	Widely distributed	<i>C. brevistyla</i> : W, W. Himalayas, Central Asia. <i>C. reflexa</i> : W, throughout India, Malay, Ceylone, etc.
Potamogetoneaceae	2	1	<i>Potamogeton</i>	16	13	Widely distributed	Widely distributed	<i>P. crispus</i> : W, Kashmir to Bhutan, elsewhere. <i>P. pectinatus</i> : W, India from plains to Himalayas, moist regions of world.
Eriocaulaceae	10	1	<i>Eriocaulon</i>	43	1	Mainly Tropical	Tropics and sub-tropics	<i>E. sieboldianum</i> : W, India, China, Japan, etc.
Pontederiaceae	7	1	<i>Monochoria</i>	2	1	Mainly America & W. Indies	Tropics & Sub-tropics	<i>M. vaginalis</i> : W, throughout India, China, etc.
Smilacaceae	4	2	<i>Smilax</i>	39	3	Widely spread	Trop. & Temp. regions	<i>S. vaginata</i> : W, W. Himalayas, Assam.
Sparganiaceae	1	1	<i>Sparganium</i>	3	2	Temp. & cold N. Hemisphere	Same	<i>S. ramosum</i> : W. N. W. India, N. Temp. regions of world.
Typhaceae	1	1	<i>Typha</i>	5	3	Temp and Trop. region	Same	<i>I. angustata</i> : W, N. India, Europe, Asia, N. Africa.
Dioscoriaceae	6	2	<i>Dioscorea</i>	34	4	Tropics & warm Temp. regions	Mainly Trop. & Subtrop regions	<i>D. deltoidea</i> : W, Temp. Himalayas, Afghanistan.

The families with the largest number of taxa are the following:

Family	Genera	Species
Compositae	94	395
Gramineae	100	250
Papilionaceae	42	163
Cyperaceae	9	148
Cruciferae	52	141
Rosaceae	29	136
Labiatae	33	127
Scrophulariaceae	26	95
Umbelliferae	44	87
Caryophyllaceae	19	83

The genera with largest number of species in Kashmir include *Polygonum* (38), *Veronica* (24), *Galium* (16), *Ranunculus* (32), *Geranium* (19), *Nepeta* (36), *Carex* (62), *Cyperus* (26), *Allium* (16), *Artemisia* (26), *Astragalus* (29), *Impatiens* (16), *Corydalis* (19), *Draba* (20), *Taraxacum* (37), *Pedicularis* (18), *Gentiana* (31), *Lonicera* (15), *Potentilla* (31), *Primula* (21), *Salix* (16).

A number of our local taxa have been misunderstood in the past, e.g. *Sambucus wightiana* Wall. ex Wight & Arnott, *Padus cornuta* (Wall, ex Royle) Carr., *Valerianella muricata* (Stev.) W. Baxt., *Ranunculus distans* Royle, *Iris hookeriana* Foster, *I nepalensis* Wall., *Rosa brunonii* Wall. *Rubus ulmi-folius* Schott, etc.

PLANTS OF NEIGHBOURHOOD

In the present Flora the forests and plains in district Srinagar are extensively surveyed. The plants from the neighbourhood include those from Sonamarg, part of Lidder Valley, Gulmarg and the Karewas.

SONAMARG TO TRUNKHAL AREA

The area lies northeast in far interior of Kashmir valley, the altitude ranging from 2,500-4,500 m. It receives occas-

sional rainfall in summre, the main rainy season being the first half of August. The snowfall starts in mid-September and continues upto end of March. The area remains under snow for most part of the year.

Beautiful alpine meadows dominate, broken up here and there by forest patches. At lower altitudes the forests are coniferous mixed with deciduous elements like *Acer caesium* Wall., *Padus cornuta* (Wall.) Carr. with few isolated *Betula utilis* D. Don; but at higher altitudes are almost pure stands of birch. The birches at such altitudes are distinctly stunted and conform very much to shrubby habit. The forest under growth is quite sparse with few isolated bushes of *Viburnum nervosum* D. Don. *Rosa webbiana* Wall., and tall herbaceous *Sambucus wightiana*, which forms stands in and around the Sonamarg valley. The forest floor, mostly laid with forest litter is dotted with *Fragaria vesca* L., *Viola sylvatica* Fries, *Podophyllum hexandrum* Royle, *Valeriana pyrolaefolia* Dcne, *Ranunculus hirtellus* Royle, etc. The scrub lands at lower elevations are dominated by deciduous shrubs *Viburnum nervosum* D. Don, occurring along with *Sambucus wightiana*. This association is dominant mostly on borders of forests. At higher altitudes *Juniperus recurva* Ham., forms large patches on slopes; mostly tall alpine herbaceous species like *Aquilegia nivalis* Jaeg occur with these.

The alpine meadows with gradual slopes are extensive and subjected to grazing: thus support low growing species like *Acomastylis elata* (Royle) Bolle, *Anemone obtusiloba* D. Don, *Sibbaldia cuneata* etc. dotted with occasional *Fritillaria roylei* Hook, patches of *Iris hookeriana* Foster. Steeper slopes are mostly stony with loose soil patches. Species like *Phlomis bracteosa* Royle, *Primula nivalis* Pall. grow to some height where grazing is not extensive. The stony bed stream situations are generally localised in mountainous grooves and are under snow for maximum period of the year. Only few short lived plants manage to grow through crevices, such as *Oxyria digyna* Hill, *Ranunculus hyperboreus* Rottlb., *Saxifraga sibirica* etc.

PLANTS OF THE AREA

- Abies pindrow* Royle
Acer caesium Wall. ex Brand
Actaea spicata L.
Adonis chrysocyathus Hk. f. et Thomas
Androsace mucronifolia Watt.
A. primuloides Duby
Allium humile Kunth
Anemone obtusiloba D. Don
Aquilegia nivalis Jaeg.
Arabis tibetica Hk. f et Th.
Arenaria serpyllifolia L.
Bergenia stracheyi (Hk. f et th.) Engl.
Betula utilis D. Don
Caltha palustris L. var *alba* Hk. f et Th.
Cerasium vulgatum L.
Chaerophyllum villosum Wall.
Chorispora sabulosa Chamb.
Corydalis govaniana Wall.
Euphorbia pilosa L.
Fragaria vesca L.
Fritillaria roylei Hk.
Geranium pratense L.
Gentiana carinata Griseb.
Iris hookeriana Foster
Juniperus recurva Ham.
Lathyrus altaicus Led.
Leontopodium alpinum Cass.
Orchis latifolia L.
Oxyria digyna Hill.
Phlomis bracteosa Royle
Plantago major L.
P. himalaica Pilger
Podophyllum hexandrum Royle
Polygonum alpinum All.
Potentilla argyrophylla Wall.
Primula rosea Royle
P. nivalis Pall.
Padus cornuta (Steud) Carr.
Pedicularis pyramidata Royle
P. punctata Decne
Ranunculus hirtellus Royle
R. hyperboreus Rottb.
Rosa webbiana Wall.
Rubus irritans Focke.
Rumex acetosa L.
Sambucus wightiana Wall. ex Wight
Saxifraga sibirica L.
Sedum quadrifidum Pall.
S. ewersii Ledeb.
S. tibeticum Hk. f et Th.
Senecio chrysanthemoides Dc.
Acomastylis elata (Royle). Belle
Sibbaldia cuneata L.
Skimmia laureola Sieb. et Zucc.
Sorbaria tomentosa (Lindl.) Rehder
Spergularia rubra (L) Presl.
Spiraea canescens D. Don
Stipa sibirica Lamk.
Taraxacum officinale Wigg.
Thlaspi cochleariforme DC. subsp. *griffithianum* (Boiss.) Jafri.
Valeriana pyrolaefolia Dcne.
V. beccabunga L.
V. serpyllifolia L.
Veronica mellissaefolia Poir.
Viburnum nervosum D. Don
Viola biflora L.
V. sylvatica Fries

LIDDER VALLEY

The Lidder valley forms the northwest of the Kashmir valley. It has a pleasant and mild look and calm and peaceful atmosphere, radiated from sober forest covered slopes and woodlands which border the valley. The main stream the Lidder, receives a number of tributaries rising from

Shieshnag and carving a deep gorge round the Pisu Hill, flows past Chandanwari on to Pahlgam.

Pahlgam is situated at an altitude of 2,667 m at the junction of the east and west Lidder streams, being surrounded by mountains crowned by high meadows. The Lidder irrigates the adjoining regions. The region is much disturbed by human habitation and cultivation, yet the areas abound in many interesting plants. Margins of streams are covered with *Sambucus wightiana* and *Viburnum nervosum*. The banks are with gravel and sand with stones, but due to fast moving streams they remain wet, plants like the following grow conspicuously: *Chenopodium blitum*, *Ranunculus laetus*, *Prunella vulgaris*, *Trifolium pratense*, *T. repens*, *Rumex nepalensis*, *Mentha longifolia*, *Delphinium incanum*, *Erysimum altaicum*, *Achillea millefolium*, *Verbascum thapsus*, *Hypericum perforatum*, *Impatiens brachycentra*, *I. sulcata*, *Cichorium intybus*, *Solidago virga-aurea* and species of *Plantago*, *Cynoglossum*, *Polygonum*, *Epilobium*, *Euphorbia*. Climbing and twining plants are represented by *Codonopsis ovata*, *Convolvulus arvensis* and *Polygonum dumetorum*.

The surrounding mountains abode several glades and meadows which present a wealth of flora. Baisaran, ca 5 km from Pahlgam, is a glade of pines vibrant with fragrant breeze from all sides. There is also a spring. From Pahlgam to Baisaran the path is very steep. Under the shade of conifers the herbaceous vegetation is chiefly *Mentha longifolia*, *Prunella vulgaris*, *Podophyllum hexandrum*, *Cucubalus baccifer* and species of *Aquilegia*, *Impatiens*, *Trillium*, and *Plantago*. Several orchids are found in the region and *Orobanche epithymum* on several habitats is met with. Near water courses *Caltha palustris* var. *alba* and several species of *Galium* are found. The common species are *Phytolacca acinosa*, *Viburnum nervosum* etc.

Lidderwat, ca 3,000 m alt., towards north of Pahlgam flanks over the Lidder; stream banks are fringed with *Rumex nepalensis*, *Angelica glauca* and *Sambucus wightiana*. The meadows of the mountains (alt. 3,334—4,334 m) abound in

Morina longifolia, *Cricus falconeri*, *Carduus nutans*, *Corydalis govaniana* and species of *Arisaema*.

Aru, 12 km off Pahlgam abounds along pony tracks in *Impatiens brachycentra*, *Stachys* sp. (in abundance), number of ferns in rocks; and *Viburnum nervosum*, *Mentha arzenis*, species of *Aquilegia* and *Geranium*, more so under pine grooves.

The dominant arboreal vegetation of this region includes *Picea smithiana*, *Pinus wallichiana*, *Abies pindrow* and several broadleaved species and evergreen species. *Pinus wallichiana* extending from 2,000-3,334 m; among the broadleaved trees chief representatives are *Juglans regia*, *Acer caesium*, *Aesculus indica*, *Parrotiopsis jacquemontiana*, *Salix* sp., *Populus* and cultivated fruit trees. At Chandanwari some of the alpine flowers are *Myosotis*, *Cynoglossum* and *Aster*.

At Kolahoi valley (alt. 4,164 m), surrounded by precipitous mountains are covered by *Betula bhojpatra*, *Juniperus recurva*, though prominent conifers are absent. On the islets formed within streams the ground is covered with *Corydalis govaniana* and species of *Pedicularis*; the margins of streams with *Angelica glauca*, *Impatiens brachycentra*, *Chenopodium blitum*, *Mentha longifolia*, *Caltha palustris*, *Primula macrophylla*. The valley abounds in *Senecio chrysanthemoides*, *Rumex nepalensis*, *Euphorbia prolifera*, *Sedum quadrifidum*, *Androsace sarmentosa*, *Saxifraga flagellaris*, *Sambucus wightiana* and species of *Ranunculus*, *Plantago*, and *Stellaria*.

More common flowering plants*

RANUNCULACEAE

Anemone falconeri Thoms.
A. obtusiloba Don
Ranunculus trichophyllus Chaix.
R. hirtellus Royle
R. pulchellus C. A. Mey
R. hyperboreus Rottb.
R. laetus Wall.
Aquilegia vulgaris Wall.
Aconitum laeve Royle

Paeonia emodi Wall.
Thalictrum elegans Wall.
T. foliolosum DC.
Caltha palustris L.
Delphinium incanum Royle
Actaea spicata L.

BERBERIDACEAE

Podophyllum hexandrum Royle

PAPAVERACEAE

Meconopsis aculeata Royle

*Arrangement of families after Bentham and Hooker.

FUMARIACEAE

Corydalis govaniana Wall.
C. moorcroftiana Wall.

CRUCIFERAE

Arabis tibetica H. f. & T.
Capsella bursa-pastoris (L) Medik
Erysimum yaltaicum Mey.
Lepidium ruderaie L.
Nasturtium officinale R. Br.
N. palustris DC.
Turritis glabra L.
Thlaspi calaminare Laj & Court.

VIOLACEAE

Viola caespitosa D. Don.
V. serpens Wall.

POLYGALACEAE

Polygala abyssinica Fresen.

CARYOPHYLLACEAE

Dianthus jaequimontii Edgew.
Cucubalus baccifer L.
Ceratium trigynum Vill.
Arenaria serpyllifolia L.
Saponaria vaccaria L.
Lychnis indica Benth.
Stellaria paniculata Edgew.

TAMARICACEAE

Myricaria germanica Desv.

HYPERICACEAE

Hypericum perforatum L.

GERANIACEAE

Geranium pratense L.
G. robertianum L.
Erodium cicutarium (L.) L. Herit.

Impatiens brachycentra Kar & Kir.
I. edgeworthii Hk.
I. gigantea Edgew.
I. glandulifera Royle
Oxalis corniculata L.

CELASTRACEAE

Euonymus hamiltonianus Wall.

SAPINDACEAE

Aesculus indica Colebr.

LEGUMINOSAE

Trifolium repens L.
Trigonella emodi Benth.
Melilotus alba Lamk.
Lotus corniculatus L.
Lathyrus aphaca L.
Dolichos lablab Linn.
Robinia pseudo-acacia L.

ROSACEAE

Spiraea canescens Don.
Rubus antennifer Hook.
Geum urbanum L.
G. elatum Wall.
Fragaria vesca L.
Potentilla argyrophylla Wall.
P. nepalensis Hk. f.
Agrimonia pilosa Ledeb.
Pyrus baccata L.

SAXIFRAGACEAE

Saxifraga flagellaris Willd.
S. sibirica L.
Bergenia stacheyi Hk. f. & T.

CRASSULACEAE

Sedum asiaticum DC.
S. ewersii Ledel.
S. oreades Hamet.

ONAGRACEAE

Epilobium angustifolium L.
E. cylindricum D. Don.
E. hirsutum L.
E. organifolium Lamk.
E. roseum Schreb.
Chamaenerion latifolium (L.) Sweet
Circaea alpina L.
Vicatia coniifolia DC.

UMBELLIFERAE

Bupleurum candollii Wall.
B. falcatum L.
Angelica glauca Edgew.
Caucalis latifolia L.
Heracleum candicans Wall.

ARALIACEAE

Hedera nepalensis K. Koch

CAPRIFOLIACEAE

Sambucus wightiana L.
Viburnum nervosum Don.

RUBIACEAE

Rubia cordifolia L.
Galium aparine L.
G. asperuloides Edgew.
G. verum L.

VALERIANACEAE

Valeriana hardwickii Wall.
V. jatamansi Jones.
V. dubia Bunge.

DIPSACACEAE

Morina langifolia Wall.
Dipsacus inermis Wall.
D. strictus Don.

COMPOSITAE

Solidago virga-aurea L.
Conyza canadensis (L.) Cronquist
Achillia millefolium L.
Tanacetum longifolium Wall.
Artemisia parviflora Roxb.
Arctium lappa L.
Cirsium falconeri Hk. f.
Crepis flexuosa (DC) B & AK
Taraxacum officinale Wigg.
T. wattii Hk.
Erigeron alpinus L.
Inula royleana DC.
Allardia tomentosa Decne.
Senecio chrysanthemoides DC.
Carduus edelbergii Rech.
Cichorium intybus L.

CAMPANULACEAE

Codonopsis ovata Benth.
C. rotundifolia Benth.
Campanula ramulosa Wall.

ERICACEAE

Gaultheria trichophylla Royle

MONOTROPACEAE

Hypopithys lanuginosa Nutt.

PRIMULACEAE

Primula macrophylla D. Don.
Androsace rotundifolia Hardw.
A. sarmentosa Wall.
Anagallis arvensis L.

GENTIANACEAE

Swertia perfoliata Royle
S. angustifolia Ham.

POLEMONIACEAE

Polemonium coeruleum L.

BORAGINACEAE

Lindelofia spectabilis Lehm.
Echinosperrum barbatum Lehm.
Lycopsis arvensis L.
Paracaryum thomsonii
Eritrichum tibeticum C.B. Cl.
Cuscuta capitata Roxb.

SOLANACEAE

Solanum nigrum L.
Hyoscymus niger L.
Datura stramonium L.

SCROPHULARIACEAE

Verbascum thapsus L.
Picrorhiza kurrooa Royle
Veronica anagallis L.
V. beccabunga L.
V. ciliata Fisch.
V. melissaefolia Poir.
Euphrasia officinalis L.
Pedicularis pectinata Wall.
P. pyramidata Royle
P. versicolor Walhb.
Digitalis lanata Ehrh.
Scrophularia polyantha Royle
Leptorhabados benthamiana Walp.

OROBANCHACEAE

Orobanche epithymum DC.

ACANTHACEAE

Strobilanthes alatus Nees
S. glutinosus Nees

LABIATAE

Origanum vulgare L.
Thymus serpyllum L.

Nepeta erecta (Bth.) Bth.
N. govaniana Benth.
Prunella vulgaris L.
Phlomis bracteosa Royle

AMARANTHACEAE

Amaranthus blitum L.

CHENOPODIACEAE

Chenopodium album L.
C. hybridum L.

PHYTOLACCACEAE

Phytolacca acinosa Roxb.

POLYGONACEAE

Polygonum affine D. Don
P. alatum Ham.
P. alpinum All.
P. amplexicaule D. Don
P. aviculare L.
P. convolvulus L.
Oxyria digyna Hill.
Rumex acetosa L.
R. nepalensis Spreng.

EUPHORBIACEAE

Euphorbia hispida Boiss.
E. pilosa L.

URTICACEAE

Cannabis sativa L.
Urtica parviflora Roxb.

BETULACEAE

Betula utilis Don

SALICACEAE

Populus ciliata Wall.

ORCHIDACEAE

Neottia listeroides Lindl.
Goodyera repens R. Br.
Epipactis royleana Lindl.
Orchis latifolia L.

IRIDACEAE

Iris hookeriana Goster

LILIACEAE

Allium blandum Wall.

JUNCACEAE

Juncus membranaceus Royle
Luzula compestris DC.

GRAMINEAE

Digitaria sanguinalis (L.) Scop.
Pennisetum flaccidum Griseb.
Stipa siberica Lam.
Poa annua L.
P. pratense L.
Setaria viridis (L.) Beauv.
Chrysopogon gryllus (L.) Trin.
Phleum alpinum L.

CONIFERAE

Juniperus recurva Ham.
Pinus wallichiana Jacq.
Picea smithiana Boiss.
Abies pindrow (Royle) Spach.

GULMARG

Gulmarg is situated west of Srinagar and is wholly mountainous, extending between 74° 28' to 74° 31' East and 34° 03' to 33° 58' North. Climatically it experiences predominantly temperate climate, though snowfall often lasts up to mid-March. However areas of perpetual snow are restricted to small pockets near the peaks, and larger portion of the alpine is snow covered till about the first week of June. There is sufficient precipitation.

A major portion of the range is dominated by dense cover of *Abies pindrow*, though associated with on southern aspect by communities of deciduous shrubs, and on the level slopes by margs. The species extends from lower limits of the range and continues up to the tree line below *Betula utilis*. At lower limits *Pinus wallichiana* and *Cedrus deodara* aggregate but these give place to *Picea smithiana* higher up. *Taxus baccata* subsp. *wallichiana* is sparsely distributed, in the lower silver fir zone. *Viburnum grandiflorum*, *Sambucus wightiana*, *Stipa siberica* dominate the forest floor; while at the ground level *Fragaria vesca*, *Geranium wallichianum*, *Poa annua*, *Polygonum amplexicaule*, *Stellaria media*, *Chrysopogon echinulatus* are common. Deciduous tree elements principally *Acer caesium*, *Corylus colurna*,

Padus cornuta and *Salix wallichiana* are scarcely represented in the *Abies* zone.

The southerly aspects extending to ca 2,700 m are usually dominated by deciduous shrubs, principally *Indigofera heterantha*, *Isodon rugosus*, *Berberis lycium*, *Rosa webbiana* and *Parotttiopsis jacquemontiana*. The herbaceous components are dominated by *Chrysopogon echinulatus*, *Artemisia vestita*, *A. nilagirica* and *Origanum normale*. Such slopes often are bordered by grooves of *Pinus wallichiana* and *Cedrus deodara*.

The nallas and network of streams have characteristic vegetation along borders and extended beds, *Populus ciliata*, *Ulmus wallichiana* subsp. *xanthoderma*, *Berberis pachyantha*, *Salix wallichiana* and *Rubus purpureus* are dominant woody species in such situations; the principal herbaceous species being *Angelica himalaica*, *Corydalis govaniana*, *Circium falconeri* and *Swertia petiolata*. In the alpine zone such beds are usually snow covered for major part of the year and a few species like *Oxyria digyna*, *Valeriana dioica*, *Caltha palustris*, *Filipendula vestita*, etc. are found. Towards the lower limit of alpine zone such beds are usually covered by *Syringa emodi*, *Betula utilis*, *Lonicera purpurea-cens*, *Berberis pachyantha* among woody species; and *Phlomis bracteosa*, *Salvia hians*, *Doronicum roylei*, *Filipendula vestita*, *Aconitum cashmeriana*, etc. among the herbaceous elements.

Though cattle grazing has largely been responsible for shaping the vegetation of several pockets, the massive meadows at Gulmarg proper and Khilanmarg have been formed due to combined effects of grazing and human interference, though Gulmarg meadow is also said to have been a lake in geologic past. The proper valley is covered largely by matted vegetation dominated by *Sibbaldia cuneata*, *Anemone obtusiloba*, *Gentiana carinata*, *Anaphalis cuneifolia*, *Taraxacum officinale* and *Plantago himalaica*. However, *Pedicularis punctata*, *Primula rosea* and *Caltha palustris* often locally common especially in damp situations. The wet lands and less disturbed areas have local aggregation of taller herbaceous species like *Circium falconeri*, *Angelica*

himalaica, *Campanula latifolia* and *Sambucus wightiana*. The matted vegetation of Khilanmarg is essentially similar to that of Gulmarg but taller herbaceous species such as *Euphorbia wallichiana* and *Iris hookeriana* dominate the meadow. The additional matted species include *Acomastylis elata*, *Bupleurum longicaule* etc. *Anemone obtusiloba* is common along upper limit to Khilanmarg meadow.

The *Betula utilis* forest forming the upper limit of tree zone occurs usually in form of pure colonies, though *Abies pindrow*, *Valeriana dioica*, *Caltha palustris*, *Filipendula vestita*, etc. are also found within them. Towards the lower limit of alpine zone such beds are usually covered by *Syringa emodi*, *Betula utilis*, *Lonicera purpurascens*, *Berberis* sp., *Sorbus lanata*, and *Corylus colurna*. Above birch zone and within it extending above towards upper limits of scrub zone are associations of *Juniperus recurva* and *Rhododendron hypenanthum*. Through their dense protected grooves they allow growth of several taller species like *Rheum webbiana*, *Saussurea lappa*, *Polygonum rumicifolium* and *Heracleum dandicans*. The southern and northern aspects of alpine slopes have distinctive vegetation, latter of densely covered moisture loving species such as *Bergenia stracheyi*, *Primula macrophylla*, *Swertia petiolata*, *Saussurea atkinsoni*, *Bistorta affine*, *Tanacetum longifolium* and *Potentilla argyrophylla*; while the former are usually sparsely vegetated with *Origanum vulgare*, *Inula royleana*, *Sibbaldia cuneata*, *Jurinea macrophylla*, *Artemisia moorcroftiana*, etc.

The more steeper alpine slopes are mostly covered with tufts of *Bistorta affine* with associated herbs such as *Tanacetum longifolium*, *Saussurea atkinsoni*, *Potentilla argyrophylla*, *Androsace primuloides*, *Jurinea macrocephala*. The areas towards peaks, which remain snow covered nearly throughout the year have short-lived desert herb communities consisting of delicate herbs like *Saxifraga flagellaris*, *Gentiana venusta*, *G. tenella*, *Draba alpina*, and *Sedum quadrifidum*.

The various types of plant communities at Gulmarg represent the effect of altitudinal, topographic, biotic and edaphic

influences and ensure rich floristic wealth to which the area owes its botanical importance. Thus of the 491 species collected so far, 424 are dicotyledons, 61 monocotyledons, and six gymnosperms; distributed over 291 genera and 62 families. Compositae is the largest family, followed respectively by Rosaceae, Ranunculaceae, Gramineae, Caryophyllaceae, Cruciferae, Labiatae and Scrophulariaceae.

Plants of Gulmarg not Recorded at Srinagar

- | | |
|--|---|
| <i>Aconitum kashmiricum</i> Stapf ex | <i>S. monosperma</i> Buch.-Ham. |
| Conventry | <i>Abutilon theophrasti</i> Medic. |
| <i>A. violaceum</i> Jacq. | <i>Oxalis acetosella</i> L. |
| <i>A. laeve</i> Royle | <i>Skimmia laureola</i> Sieb. & Zucc. |
| <i>Adonis chrysocyathus</i> Hook. f. & | <i>Astragalus malacophyllus</i> Benth. ex |
| Thoms. | Bunge |
| <i>Anemone rupicola</i> Camb. & Jacq. | <i>Lathyrus luteus</i> Baker ex Hook. f. |
| <i>A. tetrasepala</i> Royle | <i>Trigonella gracilis</i> Benth. |
| <i>Delphinium vestitum</i> Wall. ex Royle | <i>Cotoneaster acuminata</i> Lindl. |
| <i>Thalictrum alpinum</i> L. | <i>Potentilla doubjourniana</i> Camb. |
| <i>Trollius acualis</i> Lindl. | <i>P. gelida</i> C. A. Mey. |
| <i>Berberis orthobotrys</i> Bir. | <i>P. leucochroa</i> |
| <i>B. zabeliana</i> Schneid. | <i>Rubus purpureus</i> Bunge |
| <i>Papaver macrostomum</i> Boiss. et | <i>Sorbus thianshanica</i> Rupr. |
| Huet. | <i>S. lanata</i> (Don) Sch. |
| <i>Meconopsis aculeata</i> Royle | <i>Spiraea bella</i> Sims. |
| <i>Corydalis cornuta</i> Royle | <i>Saxifraga flagellaris</i> Willd. |
| <i>C. govaniana</i> Wall. | <i>S. jacquemontiana</i> Decne. |
| <i>C. stewartii</i> Fedde | <i>Ribes emodense</i> Rehder |
| <i>C. tibetica</i> Hook. f. | <i>R. nigrum</i> L. |
| <i>Arabidopsis stricta</i> (Camb.) Busch. | <i>Sedum jaesckie</i> Kurz. |
| <i>Arabis pterosperma</i> Edgew. | <i>S. wallichianum</i> Hook. |
| <i>Barbarea intermedia</i> Boreau. | <i>Chamaenerium angustifolium</i> (L.) |
| <i>Cardamine macrophylla</i> Willd. | Scop. |
| <i>Draba alpina</i> L. | <i>Pleurospermum govanianum</i> Benth. |
| <i>D. fladnitzensis</i> Wulf | <i>P. stellatum</i> Benth. |
| <i>Arenaria festucoides</i> Benth. ex | <i>Sanicula elata</i> Ham. |
| Royle | <i>Trachydium roylei</i> Lindl. |
| <i>A. orbiculata</i> Royle | <i>Vicatia conifolia</i> DC. |
| <i>Cerastium dahuricum</i> Fisch. | <i>Lonicera obovata</i> Royle |
| <i>Lychnis indica</i> Benth. var. <i>fimbriata</i> | <i>Valeriana dioica</i> L. |
| Edgew. & Hook. f. | <i>V. pyrolaefolia</i> Decne. |
| <i>Minuartia foliosa</i> (Royle ex Edgew. | <i>Morina longifolia</i> Wall. |
| & Hook. f.) Majumdar | <i>Ainslia aptera</i> DC. |
| <i>Spergularia rubra</i> (L.) Pers. | <i>Anaphalis contorta</i> (Don) Hook. f. |
| <i>Stellaria alsine</i> Grim. var. <i>undulata</i> | <i>A. cuneifolia</i> Hook. f. |
| (Thunb.) Ohwi. | <i>A. royleana</i> DC. |

- Anthemis cotula* L.
As ter falconeri Hutch.
Brachyactis pubescens (DC.) Ait & Clarke
Cicerbita laevigata (Wall. ex DC.) Steb.
Cremanthodium decainsi Clarke
Crepis kashmirica Bab.
Gnaphalium stewartii Clarke
Inula grandiflora Willd.
Lactuca brunoniana (Wall.) Clarke
Leibnitzia nepalensis (Kunze) Kitamura
Saussurea lappa Clarke
S. taraxifolia Wall. ex Hook. f.
Cassiope fastigiata D. Don
Cortusa brotheri Pax ex Lipsky
mula elliptica Royle
P. moorcroftiana Wall.
Gentiana venusta Wall.
Lomatogonium carinthiaca (Wulf.) A. Br
Swertia petiolata Royle
Polemonium coerulum L.
Cynoglossum microglochis Benth. ex Royle
Mertensia elongata Benth.
M. tibetica Clarke
Atropa acuminata Royle
Digitalis lanata Ehrh.
D. purpurea L.
Limosella aquatica L.
Linaria dalmatica (L.) Mill.
Pedicularis elephantoides Benth.
P. oederi Vahl.
P. pyramidata Royle
Scrophularia decomposita Royle
Veronica cashmirica Gaud.
Lagotis cashmiriana (Royle) Rupr.
Ajuga parviflora Benth.
Nepeta nervosa Royle
Origanum vulgare L.
Stachys mellisaeifolia Benth.
Chenopodium foliosum (Moench.) Aschers
C. murale L.
Bistorta vivipara (L.) Gray
Koeningia islandica L.
Polygonum kawagoenum Makino
P. rumicifolium Royle
Euphorbia wallichii Hook. f.
Salix denticulata Anders.
Cyperipedium cordigerum Don.
Goodyera fusca Lindl.
Allium humile Kunth
Fritillaria roylei Hook. f.
Llyodia serotina (L.) Rehb.
Trillium govaniana Wall.
Arisaema jacquemontii Blume
Carex nivalis Boot
C. vulpinaris Nees
Kobresia capillifolia (Decne.) Clarke
K. schoenoides (C.A. Mey.) Steud.
Scirpus pumilus Vahl.
Calamagrostis emodensis Griseb.
Danthonia cachemyriana Jaub. et Spach
Hierochloa laxa R. Br.
Trisetum spicatum (L.) Richt.

KAREWAS

An appreciable portion of Kashmir valley, which is of late geological origin, is occupied by pleistocene deposits of a lake which once filled the valley. These deposits locally known as 'karewas' support scarce vegetation as a result of extensive grazing and erosion. They occur as raised flat-topped plateaus separated by ravines of variable depth and consist of horizontal beds, the uppermost of which are composed of

coarse sandy material. These karewas are suitable only for rainfed crops. A part of these lying in the neighbourhood of Srinagar, and bounded by river Jhelum on one side and mountain ranges underlying Zabarwan and Twin peaks on other side, have since earliest times been under saffron cultivation.

Additional Plants from Karewas

<i>Medicago sativa</i> L.	<i>Heliotropium eichwaldi</i> Steud.
<i>Onopordum acanthium</i> L.	<i>Hypecoum pendulum</i> L.
<i>Astragalus leucocephalus</i> R. Grah.	<i>Papaver macrostomum</i> Boiss. et Huet.
<i>Kikxia subsessilis</i> Penell	<i>Silene conoidea</i> L.
<i>Cousinia microcarpa</i> Boiss.	<i>Vaccaria pyramidata</i> Medik
<i>Peganum harmala</i> L.	<i>Herniaria hirsuta</i> L.
<i>Allium rubellum</i> M. Bieb.	<i>Crepis foetida</i> L.
<i>A. ampeloprasum</i> L.	<i>Koelpinia linearis</i> Pall.
<i>Ixiolirion montanum</i> Herb.	<i>Tribulus terrestris</i> L.
<i>Tulipa lanata</i> Rgl.	<i>Iris reticulata</i> M. Bieb.
<i>Chrozophora obliqua</i> A. Juss.	

WILD PLANTS OF INTEREST IN SRINAGAR

OF MORPHOLOGICAL INTEREST : *Asparagus filicinus* Buch. Ham. (clabodes), *Hedera nepalensis* C. Koch. (parasitic roots), *Cuscuta europea* L. and *C. reflexa* Roxb. (Total plant parasites), *Orobancha alba* Steph. (root parasite), *Clematis grata* Wall. and *C. montana* Buch-Ham. (petiole climber), *Galium aparine* and *Rubia cordifolia* L. (climbing by hooked hairs), *Achyranthus bidentata* Blume (abnormal secondary growth), *Poa bulbosa* L. (viviparous), *Aeschynomene indica* L. (sensitive to touch).

HARMFUL TO MAN : *Rhus succedanea* L. (latex from freshly cut twig causes severe blisters on skin), *Urtica dioica* L. (the acid filled trichomes on the plant produce irritating effect when touched), *Euphorbia helioscopia* L., *E. prolifera* Ham., *E. pilosa* L. (milky latex causes very mild blisters on skin).

FUNGAL DISEASES (common) : Tar spot of *Rhytisma* on *Acer pictum*, *Puccinia* on *Berberis lycium* (with hypertrophy of floral parts), *Rubus niveus*, *Agropyron semicostatum*, *Artemisia vestita*, *Ustilago* (smut) on *Cynodon dactylon*, *Taphrina* on *Prunus persica* *Uromyces* on *Euphorbia helioscopia*, Downy mildew (*Bremia*) on

Lactuca spp., Powdery mildew on *Morus indica*, *Celtis caucasica*, *Craetagus*, *Juglans regia*, etc., Stigminia on *Platanus orientalis*, *Melampsora* on *Salix alba*.

MEDICINAL : *Achilla millefolium* L., *Artemisia nilagirica* (Clarke) Ham, *A. vestita* Wall., *Agrimonia eupatoria* L., *Bidens biternata* (Lour.) Merr., *Bergenia ligulata* (Wall.) Engl., *Cannabis sativa* L., *Cuscuta reflexa* Roxb., *Daphne oleoides* Schreb., *Delphinium denudatum* Wall., *Foeniculum vulgare* Mill., *Geranium nepalense* Sweet, *Galium verum* L., *Geum urbanum* L., *Hypericum perforatum* L., *Jasminum humile* L., *Onosma hispidum* Wall., *Origanum vulgare* L., *Nepeta cataria* L., *Plantago major* L., *Prunella vulgaris* L.

USED IN MATCH INDUSTRY : *Populus alba* L., *P. balsamifera* L., *P. nigra* L. var. *italica* (Much) Kochna.

SPORTS INDUSTRY : *Salix alba* L., *S. babylonica* L.

SILK INDUSTRY : *Morus alba* L.

FURNITURE AND TIMBER INDUSTRY : *Platanus orientalis* L., *Juglans regia* L., *Pinus wallichiana* Roxb.

FUEL, BASKETS, STICK MAKING : *Parrotiopsis jacquemontiana* (Dence) Rehder, *Cotoneaster nummularia* Fisch & Mey, *Indigofera heterantha* Wall.

FODDER PLANTS : *Ulmus laevigata* Royle, *Parrotiopsis jacquemontiana*, *Morus alba*, *Chrysopogon gryllus*, *Themeda anathera*.

EDIBLE FRUIT : *Morus alba*, *Fragaria vesca* L., *Rubus niveus* Thumb. *R. ulmifolius* Schott. *Prunus domestica* L., *P. persica* (L.) Stokes, *P. armenica* L., *Vitis vinifera* L., *Viburnum nervosum* D. Don, *Rosa moschata* Hern.

EDIBLE FRESH OR COOKED : *Amaranthus caudatus* L., *Allium atropurpureum* Waldst & Kit., *Capsella bursapastoris* Medic., *Chenopodium album* L., *Centaurea iberica* Trew., *Dipsacus mitis* Don, *Fagopyrum cymosum* Meissn, *Foeniculum vulgare* Mill, *Malva*

neglecta Wall., *Ophioglossum vulgatum*, *Polygonum alpinum* All., *Portulaca oleracea* L., *Plantago lanceolata* L., *Rorippa nasturtium-aquaticum* (L.) Schinz., *Rumex dentatus* L.

WILD BEAUTIES FOR YOUR GARDEN : *Equisetum* sp. (marshy banks), *Salvinia natans* (lily pool), *Marsilea quadrifolia* (marshy or shallow pond), *Asplenium septentrionale* (rock clefts), *Ceterach officinarum* (golden fern for rockery), *Adiantum venustum* (shady situations, pots), *Asplenium adiantum niger*, *A. trichomanes* (shady nooks, pots), *Pteris cretica* (along hedges, walls), *Pteridium aequilinum* (in open). The following in pots, or in beds : *Fritillaria imperialis*, *Asparagus filicinum*, *Rosa webbiana*, *Levatera kashmiriana*, *Geranium pratense*, *G. incanum*, *Bergenia ligulata*, *Lychnis coronata*, *Rosa moschata*, *Sorbaria tomentosa*, *Polygonum alpinum*, *Ferula jacobina*, *Delphinium denudatum*, *Aquilegia vulgaris*.

SIRINAGAR WOODLAND

Srinagar is flanked on the southwest and northeast by lofty Himalayan ranges. Nearest to Srinagar on southeast of it lies the famous Shankaracharya Hill, the detached ridge of igneous rock separated by the Aita Gaj Gap from Shalimar range underlying Zabbarwan and the Twin Peaks (3,220 m). The latter passes into the Harwan woodland, enclosing a ravine together with another adjacent range peaked by Mahadev (4,338 m). The Dachigam woodland is situated northeast of Srinagar at a distance of ca 18 km. This ravine is formed between a fold of massive Zaskar range. The southern mountain features bordering this ravine are the continuation of Shalimar range, underlying the peaks of Barabal (2,620 m) Bodyun (2,835 m), Chargund (2,980 m), etc. The northern range which diverges northwestwards underlies the famous Mahadev peak (4004 m). Within these two approaching mountain features, with Harwan and New Thir guarding the western doors, lies the Dachigam sanctuary: which along the northern range passes on the other side into Hayan and Suraphara reserve forests, while along the southern range into the Khunamuh reserve forest. The Dachigam sanctuary lies

approximately between $34^{\circ}, 8'$ and $34^{\circ}, 14'$ longitude, $74^{\circ}, 57'$ and $75^{\circ}, 4'$ latitude.

The effect of increased biotic influence over the ages is vividly reflected in largely barren slopes from Shankaracharya to Harwan (Plate 1), and the areas around Harwan. There is reason to believe that the same was the condition of atleast proximal parts of the ravine inhabited by the villages of Rajpur, Draphom, Drog and Dachhigam. Nearly more than half a century ago, in the reign of Maharaja Pratap Singh, the scheme for supplying drinking water to Srinagar from Marsar involved construction of a water reservoir near Harwan. To prevent pollution of this water, the villages mentioned above, situated along side the stream were vacated and the area declared a sanctuary. The vast wealth of plants now inhabiting the Dachhigam ravine (plate 2) is the perpetuation of the planted elements together with those migrating from the adjacent and deeper ranges over nearly half a century.

TOPOGRAPHY

Physical topography: The mountainous ranges enclosing the Dachhigam forest are a part of the great Zanskar range which forms the north-west branch of central Himalayan axis bifurcating near Kulu and terminating in the high twin peaks on Nun Kun (Wadia, 1939). The fold of this range enclosing the Dachhigam forest is thrown into a number of undulations enclosing narrower gulleys, and broader outflanked gulleys locally known as 'Nar'. Two steep ridges, one rising from near Harwan reservoir and another east of New Thir, form the natural boundaries of the forest, but the portion of the ravine is artificially fenced to enclose the forest. The series of undulations present a variety of slope aspects, supporting an array of vegetational types. A number of rocky cliffs and scree slopes break up the uniformity of slopes. A main stream, having its origin from Marsar and continuing up into the Harwan reservoir is fed along its course by a network of mountain drains running through the gulleys.

Geology: Complex crystalline rocks, granites, gneisses and schists form the core of the Zaskar range, a fold of which encloses the Dachhigam forest. Much of the gneiss is of intrusive origin and has invaded the rocks of various ages at a number of different geological periods. This complex is also partly sedimentary in origin, the sedimentary rocks consisting of slates, phyllites, schists with embedded crystalline limestone. The region extending from Khunamuh, Zewan, extending to near Mahadiv consists of calcareous slate, shale and bluelimestone. Most of the sediments composing these ranges have been laid from Cambrian to tertiary, and rigid and folded up during the ages (Wadia, 1939).

Kashmir is believed to have undergone four distinct glaciations, separated by interglacial warm periods. These glaciers in contrast to those in Sikkim, descend to as low as 2,500 m, and in some cases recent terminal moraines are observed at so low level as 2,200 m.

CLIMATE

Srinagar, and its environs experience an irregular climate with large interyearly variations in the precipitation amount, length of dry period and seasons of its occurrence. The average climate is sub-Mediterranean with bixeric regime having two spells of dryness, one in June and another in September to November, and high precipitation during cool seasons; though typical Mediterranean, trixeric and quadrixeric types are also met over different years. An analysis of data for the years 1968-1971, for Srinagar station, using ombrothermic diagrams (Fig. 1), revealed similar situation. With average annual precipitation for the period 1892-1971 being 664 mm, there has been sufficient fall in annual rainfall during 1970-71, the dryness continuing over the month of December, which generally is a wet month. Though bixeric regime is more common, yet the later years showed increase in number of xeric regimes from bixeric in 1963 to trixeric in 1970, to quadrixeric in 1971.

For Dachhigam woodland, a comparison of sets of data taken over different periods of the year 1971 revealed that the

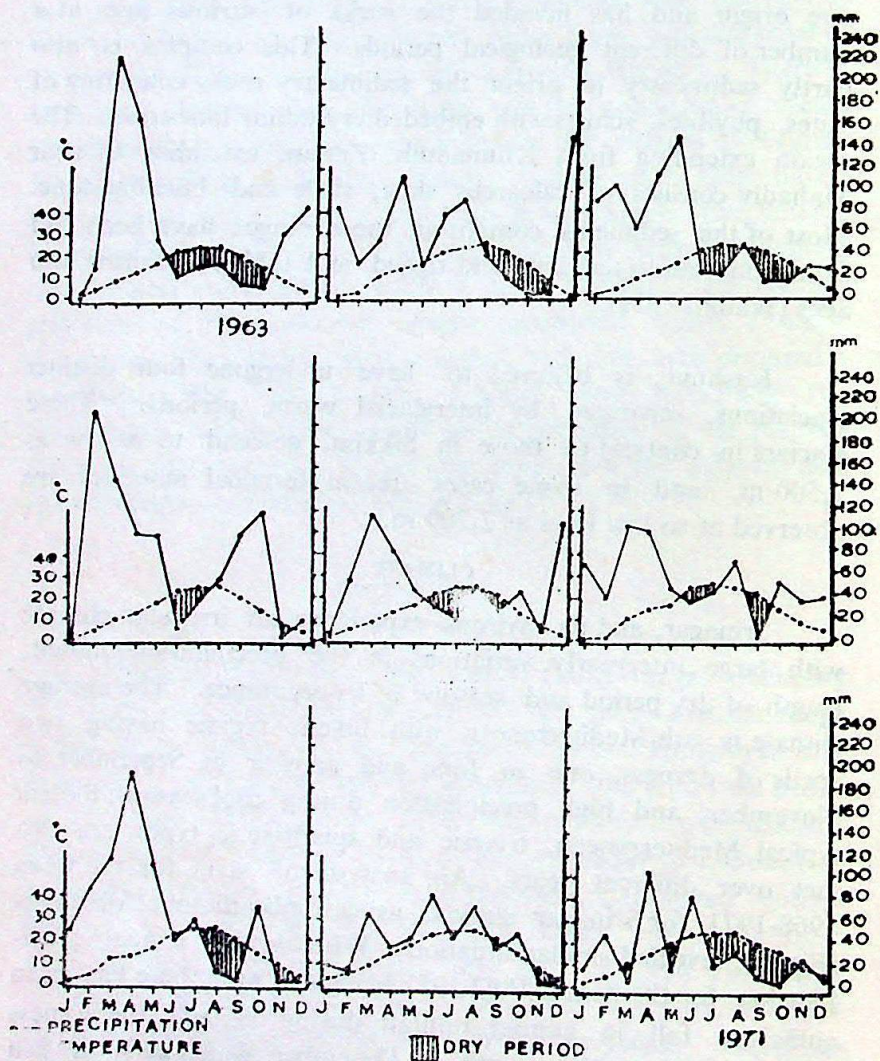


Fig. 1. Ombrothermic diagrams for Srinagar for the years 1963-1971

area experienced lower temperature averages though the rainfall was more as compared to Srinagar station. The variations of temperature over the years being very less.

The deviation in temperature was most significant in summer and winter months showing the extremes of maximum and minimum temperatures, respectively; the deviation being less marked in spring and autumn. A critical appraisal of rainfall data revealed marked increased deviation in summer months when the slopes are densely covered with vegetation. Further, gradual fall in temperature was observed to be related with increase in altitude, especially when weekly data are grouped on seasonal basis the fall being more sharp in summer when with every 200 m increase in altitude the temperature fell by 2.5°C on an average. The fall was quite gradual in winter: 0.9°C on an average with every 200 m increase in altitude. These values being somewhat comparable in spring and autumn.

It was observed that within the same altitudinal zone variation in temperature was considerable in similarly vegetated slopes facing north and south, the latter being considerably hotter. Though in the mountainous slopes showing considerable variations in exposure and slope no standard values of temperature-aspect relationship could be established, yet the results were striking. Thus, during summer, on the lower slopes the northern aspects were on an average approximately 5°C cooler than the southern aspects; during winters, the lower slopes with northern aspects were approximately 3°C cooler than the southern aspects; in both cases, the temperature falling gradually with altitude, as also do the temperature differences between northern and southern aspects.

Generally, the temperature decreased with shift from herbaceous to tree communities, the scrubs standing in between the two types. The results were marked in relation to the nature of canopy: the evergreen coniferous forests being cooler than the deciduous ones (Fig. Z). When the latter were leafless and some warming up of atmosphere in March-April, the differences were appreciable. It was during summer when both the

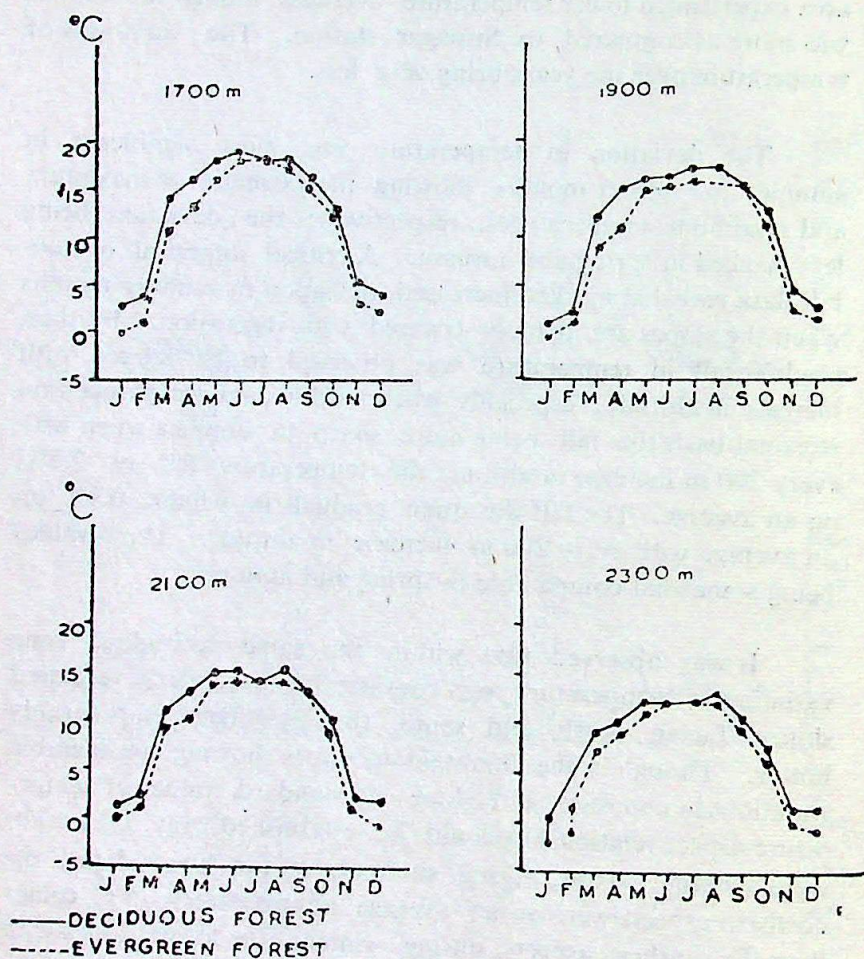


Fig. 2 Mean monthly temperatures in deciduous and evergreen forests at different altitudes in Dachhigam Sanctuary.

types of trees were in leaves, that temperature differences were lowest, though the coniferous trees with dense canopy still ensured cooler atmosphere under them. However, the temperature differences in either forest showed gradual decline with increasing altitude.

SOILS

Pedologic development of the large mountainous stretches of the area has followed the gradual process of weathering rather than the alluvial depositions which have formed the massive Karewas in Kashmir valley. Gradual erosion of surface layers on certain slopes and depositions in gulleys, however, has rendered the former immature in development, and latter skeletal with soil body embedded with stones and boulders. The portion of the ravine especially near the reservoir consists of moraine deposits carried down hill streams (and glacial drift in early geological period). Other types of developments owe their origin to different topographic, altitudinal, vegetational and other biotic influences over the ages.

Soil profiles

1. *Coniferous forest soil* : Soils developed under *Pinus griffithii* forest are well developed along the hilly slopes, and show the following profile:

AO—(0-4 cm): Showing gradual gradation from surface litter to decomposed matter below, \pm matted and often netted with roots of surface feeders like *Fragaria vesca*, *Viola falconeri*, *Anemone falconeri*, *Veronica persica*, etc.

A—(4-80 cm): Brownish black in colour, loose and rich in humus; from surface downwards becoming compacter and lighter in colour, with humus content gradually decreasing; netted with numerous roots.

B—(80 cm-2 m): Lighter brown in colour, very well developed with fine uniform soil particles, though some times having a few boulders; roots of trees and shrubs present but becoming sparse lower down.

C—(2 m-below): Lighter in colour than the above horizon

and usually of uneven thickness due to underlying bedrock.

2. *Hilly deciduous forest soil* : A typical profile has the following structure (the woody cover, usually consisting of *Ulmus wallichiana* ssp. *xanthoderma*, *Corylus colurna*, *Padus cornuta*, and *Parrotiopsis jacquemontiana*):

AO—(0-3 cm): Loose, composed of larger leaves in various stages of decomposition, seasonal fluctuations best developed often 7 cm thick in fall; thinnest in September often reduced to 1.5 cm thickness, quite often broken by large patches of perennial herbs in growing season.

A—(3-65 cm): Usually more darker in colour as compared to coniferous soils, more friable in nature; very rich in roots of herbs.

B—(65 cm-1.40 m): Greyish brown in colour due to rich organic matter, compacter and often with layers of precipitated minerals mostly near the top, boulders and stones more common.

C—(1.40 m-below): Lighter brown in colour and more compacter than the above layers; only tree and shrub roots impregnate this horizon.

3. *Moraine deciduous forest soil* : Portions of the ravine mostly consisting of washed down materials and covered with trees like *Morus abla*, *Salix alba*, *Prunus cerasifera*, *Robinia pseudoacacia*, and *Rhus succedanea*, having become naturalised have poorly developed soils which typically show the following profile structure:

AO—(0-3 cm): Essentially similar in structure to hilly deciduous forest soil, more compacter and more discontinuous due to perennial herb.

A—(3-40 cm): Almost black in colour, compact as compared to hilly soils, roots quite abundant.

B-(40-95 cm): Greyish brown in colour and very rich in smooth boulders and stones of all sizes, becoming frequent lower down; sand dominating soil particles, thickness of the horizon variable, upto 2 m.

C-(95-cm below): Usually poorly developed and often indistinguishable from the B horizon.

4. *Hilly desert scrub soil* : Developed mostly on southern aspects with sparse vegetation composed of thorn scrubs: *Rosa webbiana*, *Berberis lycium*; and tufted herbs like *Artemisia vestita*, *Origanum normale* and *Stipa sibirica*. Surface horizons poorly developed.

AO scarcely 1 cm thick, usually absent.

A usually less than 15 cm thick, brown in colour, compacter and thickly matted with herbaceous roots.

B varying considerably in thickness and having coarse textured particles of all sizes, frequent mineral precipitation very poor in organic matter.

C not well distinguished.

5. *Hilly savana soil* : Essentially similar in structure to hilly desert scrub soil but with better developed Ao, often 2-3 cm thick, A horizon upto 30 cm thick. The lower layers are essentially similar.

6. *Moraine scrub soil* : Covered with thorn scrubs and tufted grasses.

AO a 3-7 cm thick sod.

A 15-30 cm thick, less rich in humus and brownish in colour, sandy in texture.

B also mostly sandy, varying in thickness from 80 cm to 2 m, heavily impregnated with smooth boulders of all sizes (Fig 8 A).

C scarcely distinguished from the B horizon.

7. *Hill pasture soil*: Mostly developed on outflanked gulleys locally known as 'Nar'; often better developed due to deposition of humus rich soil eroded down the upper slopes. Following a thin sod layer the A horizon may be upto 30 cm in thickness and darker in colour. It gradually merges into the lighter coloured B horizon having finer soil texture. Both A and B horizons are sufficiently compact due to excessive trampling. Upper portion of the B horizon is fine and uniform textured and passes down into the portion with embedded boulders of various shapes and sizes. B horizon often reaches 2 m in thickness, passing down into lighter coloured C horizon. (Fig. 8B).

8. *Moraine pasture soil*: These soils are more akin to moraine scrub soils; though A horizon is poorer in humus and more compacter. B horizon is similarly impregnated with smooth boulders and stones. The upper layer is heavily impregnated with smooth boulders and stones. The upper layers of A horizon are finer textured but lower ones are sandy. B is equally sandy.

Physical characteristics

Soil texture: The mechanical composition of different soil types revealed definite correlation with the type of soil development. The hilly forest soils, largely residual in development are very poor in coarser particles and boulders, while the desert scrub and moraine; especially scrubby and pasture soils have considerable amount of boulders and larger sized particles.

The forest soils tend to be clayey in texture for considerable depth: while the scrub soils having only the top most layers more finer textured, have the subsurface layers prominently sandy. A textural classification of the soils following the U.S.D. A scheme revealed that the forest soils are clayey loams throughout, though the deciduous forests in the ravine tend to have clayey surface layers, lower clay content in the subsurface soils making them loamy in texture. The scrub soils as a rule are sandy loams, the sand content increasing in lower layers especially in the ravine. The pasture soils which

are more mature tend to be loamy in character in surface layers, though the subsurface layers approach the scrub soils.

The organic matter content was high in forest soils with greater input of foliage into the open scrub soils having consequently poorer organic matter. This is evidently related to southern exposure, and lower moisture content in the soil.

Water holding capacity, pore space and specific gravity etc., was carried through different forest types is given in table 1. Table 1. Data concerning water holding capacity, pore space and specific gravity for different soil types in Dachhigam reserve and adjacent areas, at surface (a, 0-8 cm) and subsurface (b, 30-35 cm) levels.

Soil type	Water holding capacity %age	Pore space %age	Specific gravity %age
Coniferous forest Soil			
a.	81.5	43.7	0.98
b.	78.3	40.2	1.01
Hilly deciduous forest soil			
a.	78.6	46.4	0.96
b.	76.2	42.1	1.01
Moraine (ravine) deciduous forest soil			
a.	78.1	42.7	1.01
b.	73.7	32.1	1.18
Hilly deser scrub soil			
a.	45.2	32.2	1.22
b.	48.1	30.4	1.28
Hilly savana soil			
a.	67.7	43.7	1.13
b.	59.4	39.9	1.23
Moraine (ravine) scrub soil			
a.	57.9	37.7	1.33
b.	43.2	42.2	1.12
Hilly pasture soil			
a.	68.1	41.1	1.13
b.	65.7	40.4	1.27
Moraine pasture soil			
a.	48.6	39.1	1.17
b.	37.5	44.7	1.14

Chemical characteristics : Chemical analysis of the soils revealed a linear relationship of organic matter (as determined through mechanical analysis) and organic Carbon in the soils. The forest soils with rich humus content, are rich in organic Carbon content while the desert scrub soils and excessively pastured dry soils of the ravine (moraine soils) are very poor in it especially in the lower layers. Nitrogen content which also showed similar relationship varies between 0.69% in forest soils and 0.06% in moraine pasture soils. The forest soils of hilly and moraine region approach each other more closely with regard to organic Carbon and Nitrogen content in the surface layers, but the moraine soils are comparatively poorer in the lower layers. The deciduous forest soils are richer in both these contents in both surface and subsurface layers as compared to the conifer forest soils. The pH of the soils ranges between 6.2 to 7.9. The forest soils are more acidic in character especially in the lower layers. Coniferous forest soils are slightly more acidic as compared to deciduous forest soils. In forest soils the pH shifts gradually towards alkaline side with depth but in scrubby soils lower layers are sharply alkaline in nature.

The soils developed under *Parrotiopsis* scrub in Dachhigam reserves and under *Isodon* scrub on Harwan mountain ranges essentially approach the forest soils in both the physical and chemical characteristics, especially when these are developed on more northerly slopes.

Soil atmosphere : The data for soil temperature and soil moisture, taken at weekly intervals along with air temperature between 12.00 and 14.00 hours, revealed that at each altitudinal zone, the forest soils were cooler than the atmosphere above excepting for the winter months when soil and air temperatures approached each other closely. In the cold winter months the surface soil was slightly colder than the atmosphere above, the subsurface soil at 25 cm depth was warmer than the surface soil, in evergreen forest being even warmer than the atmosphere above. For rest of the year, the subsurface soil was correspondingly

cooler than the surface soil. While northerly herbaceous and scrubby slopes corresponded somewhat to the deciduous forest soils (Fig. 3) in their relationships, there was corresponding increase in warmth at all the three levels : air, surface soil and subsurface soil temperatures. The southerly slopes had the surface soils considerably warmer with shift towards the scrubby and herbaceous cover, the latter having surface soil considerably more than air temperatures. The subsurface, soil, though showing corresponding increase in temperatures, was appreciably colder than the air and surface soil temperatures. The mean annual data for different altitudinal zones showed gradual decrease in soil temperatures with increase in altitude both on northern and southern aspects, the fall being more sharp in the latter especially in the surface soil, the subsurface soil showing gradual fall in temperature with increase in altitude.

The mean annual moisture percentages were found to be related to soil temperatures at the same altitudinal zone. the wetter soils being colder than the drier soils. The northerly slopes which are more wetter at all altitudes for similar reasons were considerably colder than the southerly slopes of the same altitude, the soils being drier in the latter case, especially in the surface layers.

The mean seasonal moisture data revealed a decrease in soil moisture from winter, through spring and summer months, to autumn. The southern scrubby and herbaceous slopes had a slight increase in moisture level in the surface layers in autumn months as compared to summer. This being the result of dew precipitation which increases the moisture level in the surface layers, though not appreciably. The northerly slopes which are already better in moisture content fail to exhibit this slight increase. The subsurface soils on all slopes, however, showed gradual fall in moisture content with shift from winter to autumn, as these progressively get tapped for moisture by the vegetational cover until in winter months the cessation of active plant life and

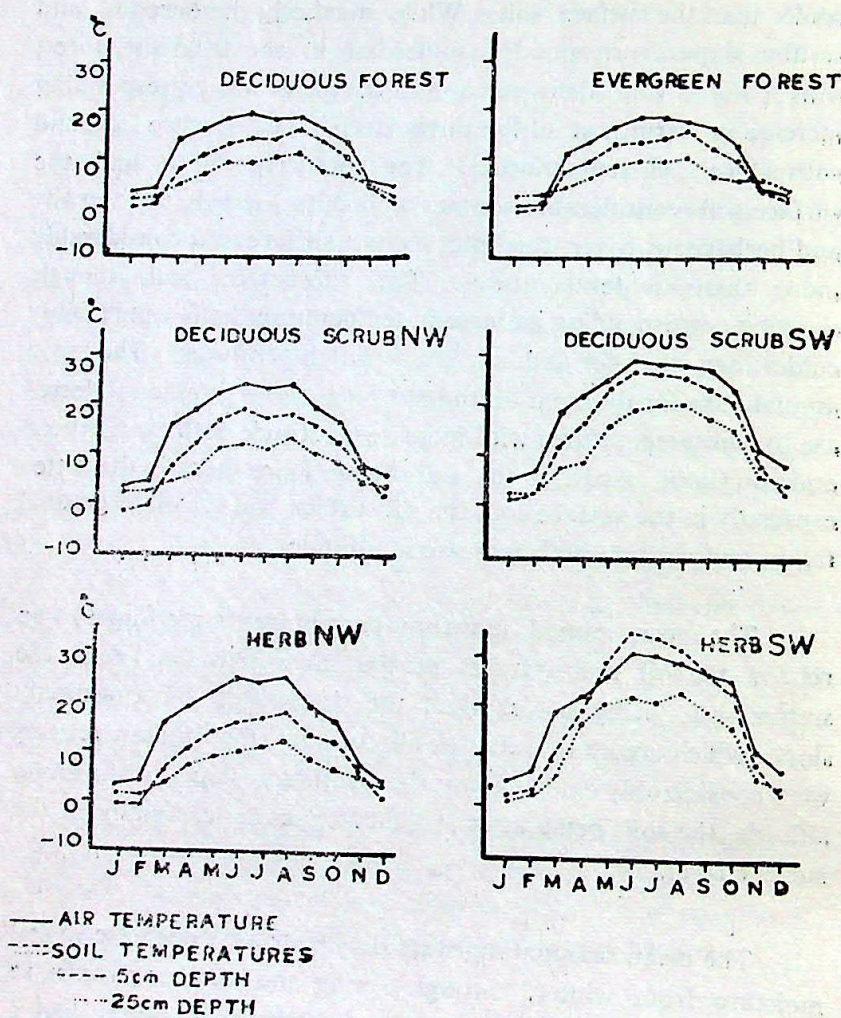


Fig. 3 Comparative mean monthly air and soil temperatures for different plant communities at 1,700 m alt. in Dachhigam Sanctuary.

increased precipitation supported by low temperatures, increased the moisture content in the lower layers as well.

The results showed that though there was appreciable difference in moisture content of surface and subsurface level in winter in all types of habitats, the southern slopes got drier in the surface layers earlier and consequently by summer the surface layers became drier than the lower layers until further tapping of lower layers towards late summer and dew precipitation in autumn brought these to almost the same moisture level.

GENERAL VEGETATION

The Dachhigam reserve and its adjacent areas exhibit a variety of vegetational types manifested by habit, form and density of dominant species, and controlled by a number of factors including habitat conditions, exposure, altitude, and above all the degree of biotic interference. However the vegetational complex could be resolved into a number of distinct types; and for limitation of these the following observations were kept in view :

1. In an area experiencing, as is true for the valley as a whole, predominantly temperate climate with Mediterranean influence, the broad leaved evergreen elements are almost lacking though needle leaved conifers are abundant.

- 2- The pyramidal form of most of the conifers and conspicuous branching keeps the floor sufficiently shaded in such forests throughout the year, and the stratification is very poor.

3. The broad leaved trees are exclusively deciduous and the sclerophyllous types among these are scarce. Such deciduous forests usually remain naked for nearly half of the year, and thus the stratification is well developed, a consequence of better illumination.

4. The influence of various factors manifests significantly in the leaf size of dominant community stratum, in addition to its characterisation in under strata.

5. The degree of protectiveness of the dominant plant type often reflects the degree of biotic interference.

6. There is great variety of herbaceous elements in the valley as a whole, as is also true for our area, suggesting the need for recognition of ample subtypes in such communities.

7 The area being mostly mountainous and having uneven topography, the closed and steppe types in communities are not well separated so as to deserve recognition as distinct types.

CONSPECTUS OF VEGETATIONAL TYPES

- A. Plants of the dominant community separated by not more than twice their crown width.
 1. Evergreen sclerophyll forest
 - I Blue pine forest
 - II Silver fir forest
 2. Deciduous forest
 - I *Robinia pseudoacacia* community
 - II *Morus alba* community
 - III *Corylus-Padus* association
 - IV Birch forest
 - V *Salix alba* plantation
 3. Evergreen scrub
 - I Tall evergreen scrub
 - II Dwarf evergreen scrub
 4. Deciduous scrub
 - I Deciduous *Parrotiopsis* scrub
 - II Deciduous microphyll scrub
 - III Deciduous thorn scrub

5. Savana (graminoid vegetation with scattered trees)
 - I Tall savana (herbs more than 1 m tall)
 - II Dwarf savana (herbs less than 1 m tall but not close to the ground)
 - III Matted savana or parkland savana (pastures-herbs atleast their vegetative parts close to the ground).
6. Scrub savana (graminoid vegetation with scattered scrubs)
 - I Tall scrub savana
 - II Dwarf scrub savana
 - III Matted scrub savana or parkland scrub savana
7. Scrubby broad leaved herb (non - gramnoid vegetation with scattered scrubs)
8. Grassland (predominantly graminoid vegetation): seasonal
 - I Tall grassland
 - II Dwarf grassland
 - III Matted grassland or grassy parkland (Pastures)
9. Broad leaved herb (non graminoid): seasonal
 - I Tall broad leaved herb.
 - II Dwarf broad leaved herb
 - III Matted broad leaved herb or broad leaved parkland (alpine pastures)
10. Marsh
 - I Seasonal mosophyll marsh (non-graminoid)
 - II Seasonal sclerophyll marsh (graminoid)
11. Submerged meadow : seasonal
12. Floating meadow : seasonal

- B. Plants of the dominant community separated by more than twice their crown width.

13. Desert

I Desert scrub

II Desert herb

a. Seasonal desert grass

b. Seasonal desert herb

Evergreen forests : Developed on more mature soils, the evergreen forests are exclusively coniferous, the sclerophyllous needle leaves being best adapted to survive over winter. *Pinus griffithii* is the dominant conifer at lower altitudes. In dense stands with trees almost touching each other, the under strata are poorly developed, lianas being largely absent. Isolated individuals of *Lonicera quinquelocularis*, *Viburnum cotinifolium*, *Rosa webbiana*, *Berberis lycium*, etc., form sparse scrubby layer, the herbaceous cover being dominated by *Stipa sibirica*, *Artemisia vestita*, *Origanum normale*, *Polygonum amplexcaule*, *Heranium wallichianum*, etc. The conifer forests at higher altitudes are dominated, in the inner ranges, by silver fir (*Abies pindrow*) with usual association of *Picea smithiana*, *Taxus wallichiana*. In the lower belt of silver fir zone *Pinus griffithii* occurs commonly associated but disappears higher up.

In open stands of conifer forests, is deciduous tree elements. These have better developed strata, and besides deciduous woody species lianas are also present.

Deciduous forests : Deciduous forest communities dominate the landscape in Dachhigam ravine, These are predominantly mesophyllous and include the following distinct communities :

- a. *Robinia pseudoacacia* : community which is often quite dense due to excessive propagation by suckers. In mature

stands there is hardly any deciduous tree species other than this and the herbaceous cover is very poor.

b. *Morus alba* : community being more representative in Dachhigam ravine, often forms very close stands. Though the stratification is poorer the commonly associated lianas include *Vitis vinifera*, *Rosa brunonii*, *Hedera nepalensis* and *Clematis grata*. Scrubs and herbaceous cover is quite poor.

c. *Corylus-Padus* : association being present in the form of smaller stands on mountain slopes have very good stratification afforded through better illumination, humus rich soils and better moisture content.

d. *Brich* (*Betula utilis*) : forests are found above the level of 3,000 m and often from pure stands though at lower limits silver fir is commonly associated together with scrubs *Rhododendron campanulatum*, *Syringa emodi*, etc. Higher up the birch loses its stature and in its upper limit the plants have scrubby habit.

In addition the plantations of *Salix alba* are distributed in the ravine along water reservoir and towards the artificial fencing. These support several marshy and swampy species, though on more drier habitats the scrubby species are very well distributed.

Evergreen scrub : Such communities are very scarce at lower altitudes but at upper limits the scrub zone has dwarf scrub communities dominated by *Rhododendron anthopogon* and *Juniperus recurva*. Several taller herbaceous species like *Aguilegia fragrans*, *Cimicifuga foetida*, *Saussurea candolleana*, and *Actaea spicata* are commonly associated. Above the silver fir zone the isolated stands dominated by tall evergreen scrub *Rhododendron campanulatum* are met along the stream sides and on borders of birch forests.

Deciduous scrub : These are quite common on northerly slopes of reserve on outer ranges. The following types are encountered :

a. *Parrotiopsis* : scrub dominates the landscape on the southern range on the northerly slopes. Several woody species occur associated and good illumination supported by rich humus content affords better stratification of herbaceous cover.

b. Deciduous microphyll scrub dominated by *Isodon plectranthoides* is very common on mountain slopes outside the sanctuary, and having northerly aspects. The commonly associated woody species include *Rosa webbiana* and *Berberis lycium*, the herbaceous vegetation being commonly represented by *Stipa sibirica*, *Artemisia vestita* and *Origanum normale*.

c. Deciduous thorn scrub communities being well represented in the ravine and southerly aspects of mountain slopes are usually dominated by *Rosa webbiana*, *Berberis lycium*, though *Rosa brunonii* is more commoner in the ravine.

Savana : Stands of taller grasses though occasional in the area, it is only on the moister slopes that true savanas with scattered trees are present. *Stipa sibirica*, *Poa stewartiana* usually from such savanas. A considerable portion of the mountain slopes being progressively enclosed and acquired by the local people is subjected to comparatively less grazing and trampling. Such areas with scattered trees, often planted, support luxuriant growth of dwarf and matted grasses like *Bothriochloa pertusa*, *Cynodon dactylon* supported by *Centaurea iberica*, *Trifolium dubium*, *Cichorium intybus*, etc.

Scrub savana : These are more commoner than the true savanas and dominate the southern slopes of the reserve which are more steeper, and portions of the ravine. These are dominated by *Chrysopogon echinulatus*, *Themeda anathera*, *Mulenbergia huegelii* and supported usually by taller herbaceous species

like *Saussurea albescent*, *Heracleum candicans*, and *Ferula jaeschkeana*.

The matted scrub savanas are usually situated on slopes outside the sanctuary as a transition zone between matted savana and microphyll scrub.

Scrubby broad leaved herb : The humus rich steeper slopes outside the sanctuary, being subjected to considerable disturbance are largely denuded of usual woody vegetation, The humus rich soil, however, supports several herbaceous species like *Fritillaria imperialis*, *Origanum normale*, *Artemisia nilagirica*, *Crambe cordifolia*, *Allium atropurpureum*, *Corydalis diphylla*, etc. forming seasonal broad leaved herb communities with scattered scrubs.

Grasslands : Taller grasses like *Chrysopogon echinulatus*, *Themeda anathera*, *Muhlenbergia huegelii*, often form small stands on mountain slopes. Similarly *Stipa sibirica*, *Poa stewartiana* also form similar stands on moister stands. The matted savanas which are usually present on outflanked gulleys are dominated by *Cynodon dactylon* and *Bothriochloa pertusa*.

Broad leaved herb : Though grasses dominate most of the herbaceous communities, broad leaved herbs often form pure stands near moist situations. Well developed communities of *Sambucus wightiana* along pathways outside the reserve on northern range are commonly met. Dwarf communities often well distributed on humus rich disturbed soils are usually dominated by *Fritillaria imperialis*, *Corydalis diphylla*, *Geranium lucidum*, etc. Matted pastures of broad leaved herbs are met in the alpine zone being dominated by *Sieversia elata*, *Anemone obtusiloba*, *Sibbaldia cuneata*, etc.

Marsh : Marshes are invariably seasonal. Sclerophyll types consist of sedges notably *Carex foliosa*, *C. cernua*, *C. psychrophylla*, and grasses like *Agrostis stolonifera* and *Polypogon fugax*.

are more commoner in shallow water situations, deeper waters having mesophyll species like *Alisma plantago-aquatica*, *Rumex patientia* Ssp. *orientalis* etc.

Submerged meadow : Though rare, such meadows formed especially of *Ranunculus trichophyllous*, *Potamogeton crispus* occur in deeper waters. These are all seasonal as also those formed in deeper ponds by *Callitriche stagnalis*.

Floating meadow : This consists of *Lemna* sp. forming thalliform meadows and microphyll meadows are formed of *Salvinia natans*. Such communities occur in ponds and rice swamps.

Desert scrub : Though true desert conditions are lacking steeper slopes on southerly aspects with excessive grazing often result in erosion so that most of the ground is barren with isolated individuals of thorn scrubs or microphyll scrubs. Some poisonous herbs are distributed in such communities.

Desert herb : Such situations are rather rare, being found on flood plains and areas where grazing is intense or where recent erosion has exposed new soil. These are all seasonal. The areas of intense grazing have *Cynodon dactylon* and *Bothriochloa pertusa* as the usual species, while the eroded areas support isolated individuals of *Convolvulus arvensis*, *Poa annua*, *Clinopodium umbrosum*, etc.

COMMUNITY CHARACTERISTICS

The woodland areas show a strong vegetational contrast with the outside areas, which are subject to varied type of biotic interference. Though transitions from mountain slopes to the valleys below occur, the two differ in the composition and structure of vegetation. While the mountain slopes of woodland support mostly natural vegetation, the portions of ravine are inhabited by mixture of planted elements and natural vegetation.

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The valley outside the woodland is largely under cultivation with patches of pastures and flood plains. The mountain slopes outside especially above Harwan village are largely barren being dominated by pastures and scruby communities, though some area are enclosed for cultivation. In consideration of this, the area is divided into four ecological regions:

(1) Dachhigam mountain slopes, (2) Dachhigam ravine, (3) Harwan mountain slopes, and (4) Harwan-New Thir valley.

Dachhigam mountain slopes

Mountain slopes of the sanctuary which form greater part of the reserve, depict a variety of topographic irregularities exhibited in aspect, slope, altitude and habitat characteristics. Starting from near 1,700 m the slopes of the southern range reach 2,500-3,000 m, the northern range being considerably higher, the highest being Mahadiv peak 4,000 m high.

Though smaller topographic variations occur due to undulating nature of each range, the over all exposure of the ranges follows a related course. The southern range, which has north-western aspect changing to western while passing from Harwan towards Shalimar and Nishat, the ridge forming the western boundry of the sanctuary above from near Harwan reservoir marks the line of shift towards northeastern aspect in the sanctuary. Passing inwards the general aspect of range shifts from northeast to north and from near Draphom it shifts northwest in exposure.

The northern range having southwestern exposure while approaching the sanctuary, suddenly turns southeast, again turning southwest, until from near Mahadiv it takes southern exposure; passing inwards it shifts towards southeastern in exposure, approaching the opposite range.

The mountain slopes of the reserve, largely protected from biotic influence, support a number of distinct communities characterised by structure and composition.

Blue pine forest: The coniferous forests formed of blue pine (*Pinus griffithii*), though more common deeper in the sanctuary, occur as isolated grooves of variable sizes on the slopes overlying the ravine between Harwan reservoir and Draphom. Though blue pine in the inner ranges passes slowly into silver fir (*Abies pindrow*) above 2,300 m: the former rarely forming pure stands above that altitude, these outer ranges of the sanctuary have pure stands of blue pine reaching often 3,000 m.

Blue pine forests at lower levels closer to the ravine, though essentially lacking in the deciduous tree elements of the ravine, include scruby elements from adjacent slopes, which are quite rich in these. Woody composition of such a lower level blue pine forest (alt. 1,700-1,800 m, aspect northeast) with height ranges, is given below:

Species	Principal height class range	Species	Principal height class range
<i>Pinus griffithii</i>	V-VI	<i>Berberis pseudumbellata</i>	III
<i>Rosa brunonii</i>	III-IV	<i>Isodon plectranthoides</i>	II-III
<i>Parrotiopsis jacquemontiaua</i>	II-III	<i>Rosa macrophylla</i> var. <i>minor</i>	III
<i>Rosa webbiana</i>	II-III	<i>Rhus succedanea</i>	IV-V'
<i>Rubus antennifer</i>	II-III	<i>Prunus cerasifera</i>	IV
<i>Indigofera heterantha</i>	II-III	<i>Hedera nepalensis</i>	I-IV
<i>Lonicera quinquelocularis</i>	II-III	<i>Berberis lycium</i>	III
<i>Jasminum humile</i>	II-III	<i>Daphne oleoides</i>	II-III
<i>Viburnum cotinifolium</i>	III-IV	<i>Crataegus monogyna</i>	III-IV
<i>Rubus ulmifolius</i>	III	<i>Cotoneaster aitchisoni</i>	III
<i>Euonymus fimbriatus</i>	III		

Grooves of blue pine shaded for whole of the year, have poorly developed stratification, the scruby layer being quite sparse, most of the woody species scarcely crossing the height class III. The openings in these forests with better illumination are thickly vegetated with scrubs like *Rosa brunonii*, *R. webbiana*, and *Rubus niveus*. Tree species *Rhus succedanea*, *Crataegus monogyna*, *Aesculus indica*, *Celtis caucasica* and *Prunus armeniaca* also occur isolated in these openings.



Plate 1. A blue pine community on Dachhigam mountain slopes surrounded by scrub savana.



Plate 2. A closer view of matted scrub savana outside Dachhigam reserve. Isolated *Berberis lycium* and *Sripa sibirica*.

Large areas of the mountain slopes are primarily composed of deciduous scrubs; these also form major components of blue pine forests. *Rosa webbiana*, *R. brunonii*, *Indigofera heterantha*, *Jasminum humile* form savana slopes and thorn scrub communities, and *Parrotiopsis jacquemontiana*, *Rubus antennifer*, *Viburnum cotinifolium*, etc., from the *Parrotiopsis* scrub, form the core of understrata in the blue pine forests.

The sequence of woody species is well marked along the transition from dense blue pine forest to the deciduous *Parrotiopsis* scrub (Table 12), lying on the same aspect though slightly northwards. There is marked increase in the cover of scrubby species while passing out from the blue pine forest. With decrease in blue pine canopy there is corresponding increase in the scrubs, being related to better illumination and reduced competition with blue pine. With shift towards *Parrotiopsis* scrub, there is corresponding increase in the cover of *Parrotiopsis*, resulting in decrease in other scrubs. Deciduous canopy of *Parrotiopsis*, however, allows better development of these scrubs as compared to their performance in the blue pine community.

Blue pine forests at higher levels though having essentially similar structure, have several distinctive species and woody composition of a higher level blue pine forest (alt. 2,300 m, aspect northern) in sequence of decreasing Importance Value of the species, and height ranges of the species is as follows :

Species	Principal height class range	Species	Principal height class range
<i>Pinus griffithii</i>	VI	<i>Jasminum humile</i>	III
<i>Viburnum cotinifolium</i>	III-IV	<i>Berberis pseudoumbellata</i>	II-III
<i>Staphylea cmodi</i>	III-IV	<i>Lonicera quinquelocularis</i>	II-III
<i>Rubus pungens</i>	II	<i>Spiraea canescens</i>	III
<i>Berberis pachyacantha</i>	III	<i>Smilax vaginata</i>	II
<i>Parrotiopsis jacquemontiana</i>	II-III	<i>Corylus colurna</i>	IV-V
<i>Rosa macrophylla</i> var. <i>minor</i>	III	<i>Cotoneaster rosea</i>	II-III
<i>Indigofera hebeptala</i>	II-III	<i>Acer cappadocicum</i>	IV
<i>Isodon plectranthoides</i>	II-III		

Mature forests developed on northern aspects are mostly represented by mesophyll species like *Staphylea emodi*, *Rosa macrophylla* var. *minor*, *Rubus pungens* and *Viburnum contini-folium* which, however, as is true for dense conifer forests in general, show decrease with shift towards increase in blue pine coverage.

The seasonal sequence of herbaceous species is determined among other things, by general aspect and altitudinal characteristics of slopes. The blue pines in general distribution occur on north to northeast aspects, quite rarely extending to northwest. At lower levels of reserve on northeastern exposure, the herbs come to active life about the middle of March with emergence of rosette leaves of *Plantago lanceolata*, *Taraxacum officinale*, *Viola sylvatica*, etc., and emergence of vegetative buds of *Fragaria vesca*, *Origanum normale*, *Ferula jaeschkeana*, *Artemisia vestita*, etc. Only a few liliaceous species like *Colchicum luteum*, *Gagea kashmirensis*, however, start emerging about a fortnight earlier. The increased impetus to herbaceous growth comes by warmth of April, when vegetative parts of several species including *Artemisia indica*, *Saussurea albescence*, *Heracleum candicans*, *Polygonum amplexicaule*, *Carex setigera* var. *schlagintweitiana*, and *Stipa sibirica* start sprouting, and through slow growth during summer months attain their maximum development, reproducing partially and continuing their life cycle mostly through vegetative growth for most of the year, till winter conditions set in.

The striking reduction of annual species in blue pine forests especially in spring when most of the adjacent slopes are very rich in annual species, is evidently a consequence of low reproductive potential in the community and poor growing conditions the perennial species which are well represented maintain themselves largely by vegetative propagation. It is not until the summer months that the blue pine stands have better conditions



Plate 3 A closer view of *Parrotiopsis jacquemontiana* community
in Dachhigam Reserve. Isolated blue pines.

for flowering of herbs, but only a small percentage of individuals actually flower.

Seral blue pine communities: Seral blue pine communities are generally located in the areas subjected to fire, moraine deposits at higher altitudes, and along ecotone between silver fir and scrubs. Isolated grooves of blue pine also occur in scruby and savana communities intercepted by local topographic change towards northern exposure. Such seral blue pine communities which are more commoner on outer ranges of the sanctuary and adjacent slopes sometimes reach the altitude of 3,000 m. The composition of these blue pine communities is largely determined by the type of surrounding vegetation. In a blue pine community developed in the 'fire' area on northeast-southeast exposure the microphyll scrubs *Isodon plectranthoides*, *Indigofera heterantha*, together with thorn scrubs *Rosa webbiana*, *Rubus niveus*, *Berberis lycium* are dominant woody associates. The herbaceous layer is dominated by *Chrysopogon echinulatus*, *Themeda anathera*, *Carex setigera* var. *schlagintweitiana*, *Ferula jaeschkeana*, *Heracleum candicans*, *Saussurea albescence* and *Artemisia vestita*. The herbaceous species in such communities generally have well protected massive rootstock, having survived the destruction by fire.

The scruby slopes dominated by *Isodon plectranthoides*, *Stipa sibirica*, *Artemisia nilagirica*, *Spiraea canescens* are generally developed on northerly slopes and are maintained as such by grazing and lopping effects on the borders of the sanctuary. The gulleys or steeper slopes in such communities being protected from such influences often support grooves of blue pine with association of these species. In addition to *Berberis pseudumbellata*, *Rosa macrophylla* var. *minor*, *Viburnum grandiflorum*, etc. Such blue pine communities have local distribution of herbs like *Fragaria vesca*, *Polygonum amplexicaule*, *Prenanthes brunoniana*, and *Geranium wallichianum*.

The communities of blue pine developed on moraine deposits and slided down materials are more distinctive in having better humus content and rich soil material. Scrubby species *Rosa macrophylla* var. *minor*, *Berberis pseudounbellata*, *Viburnum grandiflorum*, *Salix wallichiana*, *Lonicera discolor*, *Rubus pungens*, etc., form the usual associates. Deciduous trees *Acer caecium*, *Padus cornuta*, *Fraxinus hookeri*, often occur as isolated individuals. The herbaceous species in such communities are generally the taller species like *Dipsacus mitis*, *Polygonum alpinum*, *P. amplexicaule*, *Thalictrum minus* var. *major*, *Stachys sylvatica*, *Saussurea candolleana* and *Cirsium falconeri*, though low growing species like *Fragaria vesca*, *Geranium wallichianum* and mesophytic mosses are quite common.

In their general structure the seral blue pine communities are usually open allowing associated woody and herbaceous species to grow favourably.

Silver fir forest: Forest communities dominated by silver fir (*Abies pindrow*) dominated the landscape on inner ranges and extend from near 2,300-3,200 m. In the lower level where these often descend down to near 2,100 m the silver fir forests pass into blue pine, the latter slowly disappearing upwards. In the upper limits the silver fir passes into birch.

The lower limit of silver fir usually has the association *Rhus succedanea*, *Ulmus wallichiana* Ssp. *xanthoderma*, *Aesculus indica*, *Acer cappadocicum*, *Celtis caucasica*, *Crataegus monogyna* which disappear upwards. Scrubby species *Isodon plectranthoides*, *Rosa webbiana*, *Indigofera heterantha*, *Lonicera quinquelocularis*, *Viburnum continifolium*, dominate the scrubby stratum. The herbaceous layer is usually dominated by *Dipsacus mitis*, *Thalictrum pedunculatum*, *Artemisia nilagirica*, *A. indica*, *Fragaria vesca*, *Geranium pratense*, *G. wallichianum*, *Muhlenbergia huegelii*, *Oryzopsis munroi*, *Polygonum amplexicaule*, *Poa stewartiana* and *Carex setigera* var. *schlaginweitiana*.

In the middle of silver fir zone at about 2,700 m altitude and northeasterly exposure, the silver fir is associated with all the three coniferous tree species (*Picea smithiana*, *Taxus wallichiana*, and *Pinus griffithii*) present in the woodland though these three species combined contribute a small part of total tree cover as compared to silver fir and occur as isolated individuals in silver fir forest. The deciduous tree elements (*Acer ceacium*, *Euonymus hamiltonianus*, *Padus cornuta*, *Staphylea emodi*, *Corylus colurna*, *Salix wallichiana*, and *Aesculus indica*) often locally common on more northern slopes, also form a small part of tree coverage. In this zone the principal scrubs in order of decreasing importance include *Viburnum grandiflorum*, *Parrotiopsis jacquemontiana*, *Viburnum cotinifolium*, *Rosa macrophylla* var. *minor*, *Berberis pachyacantha*, *Lonicera discolor*, and *Isodon plectranthoides*. The herbaceous layer in the zone is well developed, the area being well protected. The principal species along drains include *Doronicum roylei*, *Caltha palustris* var. *alba*, *Filipendula vestita*, *Rumex acetosa*, *Ranunculus distans* and *Prunella vulgaris*. The general forest floor is dominated by *Geranium wallichianum*, *Polygonum amplexicaule*, *Prenanthes brunoniana*, *Fragaria vesca*, *Dactylis glomerata*, *Artemisia nilagirica*, *A. indica*, *Cicerbita cyanea*, *Geum urbanum*, etc.

In its upper limit the silver fir zone passes into birch. In its upper belt (alt. 3,100 m) with fir and birch as principal components, the alpine species *Rhododendron campanulatum*, *Syringa emodi*, *Betula utilis*, *Viburnum grandiflorum*, *Salix wallichiana*, *Lonicera purpurascens*, *Rosa macrophylla* var. *minor*, *Berberis pachyacantha*, *Lonicera discolor*, and *Juniperus recurva*, and lower level species *Viburnum grandiflorum*, *Berberis pachyacantha*, *Salix wallichiana* and *Lonicera discolor* form the woody components. The herbaceous cover has several taller species like *Aster thomsonii*, *Saussurea candolleana*, *Cimicifuga foetida*, *Aquilegia fragrans*, *Valeriana hardwickii*, in addition to

low growing *Fragaria vesca*, *Aster diplostaphoides*, *Jaeschkea latiseppala*, *Sieversia elata*, *Anemone obtusiloba*, *Bupleurum longicaule*, *Sibbaldia cuneata*, etc.

Birch forest: The forests dominated by birch (*Betula utilis*) extend between 2,000 to 3,700 m, lying in the gulleys between ridges and on northerly slopes. At lower levels the birch extends into silver fir, where both the alpine and lower level species occur in association. Higher up, the silver fir disappears and birch forms pure stands. There are a very few woody species that come into the composition of birch forest (alt., 3,300 m), these also disappear higher up; but the birch extends upto the glacial moraine deposits. These species are listed below :

Herbaceous species	Woody species
<i>Sieversia elata</i>	<i>Betula utilis</i>
<i>Sibbaldia cuneata</i>	<i>Rhododendron campanulatum</i>
<i>Anemone obtusiloba</i>	<i>Syringa emodi</i>
<i>Aster thomsonii</i>	<i>Lonicera discolor</i>
<i>Iris hookeriana</i>	<i>L. purpurascens</i>
<i>Saussurea atkinsoni</i>	<i>Rhododendron anthopogon</i>
<i>Fragaria vesca</i>	<i>Juniperus recurva</i>
<i>Saussurea candolleana</i>	<i>Gaultheria trichophylla</i>
<i>Veronica melissaefolia</i>	
<i>Jaeschkea latiseppala</i>	
<i>Gentiana tenella</i>	
<i>Anaphalis nepalensis</i>	
<i>Leontopodium alpinum</i>	
<i>Osmunda claytoniana</i>	
<i>Silene tenuis</i>	
<i>Salvia hians</i>	
<i>Cerastium fontanum</i> Ssp. <i>triviale</i>	
<i>Stachys sericea</i>	
<i>Phlomis bracteosa</i>	

The altitudinal effects in dwarfing of birch individuals, primarily related to prolonged snow cover and faster winds are accompanied by modifying the growing habit of birch. In addition to transformation of tree habit into scrubby habit, there is progressive increase in the snow bends of birch individuals at higher altitudes. Scrubs *Rhododendron campanulatum*, and *Sy. inge emodi*. This effect also well marked in silver, in addition to being related to steepness of slope also appears to be related to the duration of snow cover.

The birch zone extending from upper limits of silver fir forests upwards, exhibits gradual dwarfing in the birch individuals, the upper limits of birch represented by scrubby habit, often less than 1 m tall. The reduction in the height is also accompanied by decrease in stem girth of the birch individuals. On an average, with every 100 m increase in altitude the birch decreases 90 cm in height and 3 cm in stem width.

The herbaceous activity of the birch forests is restricted to a short period of summer months when the snow melts. A number of perennial species with massive rootstocks flourish during this short growing season. The number and density of species decreases higher up towards the glacial moraines where snow cover remains for nearly ten months of the year. The usual herbaceous components of birch include *Sieversia elata*, *Sibbaldia cuneata*, *Anemone obtusiloba*, *Aster thomsonii*, *Iris hookeriana*, *Saussurea atkinsoni*, and *Fragaria vesca*. At upper limits most of these species disappear and *Ranunculus hirtellus*, *Oxyria digyna*, *Trigonella emodi* and *Phlomis bracteosa* form the sparse herbaceous cover.

Corylus-Padus association : Only well developed deciduous forest communities at lower levels than birch zone are those of *Corylus-Padus* association; the deciduous forest communities being very poorly represented on the mountain slopes. The usual tree species in *Corylus-Padus* association, which extends

between 2,300 m and 2900 m in the outer ranges of Dachhigam reserve in the form of small grooves, include *Ulmus wallichiana* Ssp. *xanthoderma*, *Acer cappadocicum*, *Pinus griffithii*, *Taxus wallichiana* and *Aesculus indica*. The scrubby associates primarily consist of mesophyll scrubs as are found in the blue pine forests of same altitudinal zone. The usual species include *Parrotiopsis jacquemontiana*, *Staphylea emodi*, *Berberis pachyacantha* and *Rosa macrophylla* var. *minor*. The herbaceous cover includes several taller species like *Dactylis glomerata*, *Artemisia nilagirica*, *Saussurea albescent*, *Lathyrus altaicus*, *Polygonum amplexicaule*, *Silene vulgaris*, *Dioscorea deltoidea*, *Polygonatum multiflorum*, *P. verticellatum*, *Stipa sibirica* and *Dipsacus mitis*.

As compared to the blue pine forest of the same altitudinal zone, the *Corylus-Padus* association, though having essentially similar composition, shows well defined stratification, which is well appreciated in summer months when both type of communities have maximum development of herbaceous cover. In the blue pine community, the maximum cover is contributed by the blue pine itself, the understrata being quite sparse, except for ground cover formed by herbs; mostly the low growing species. The deciduous *Corylus-Padus* association, however, exhibits a better marked stratification, being well represented in all height classes.

Seasonal pattern of the herbaceous cover, which is very rich in *Corylus-Padus* association, shows strong seasonal fluctuations. Though scattered individuals of *Colchicum luteum*, come up in early March, most of the herbaceous species begin sprouting in last week of March. Considerable warmth being afforded to ground floor in April: the deciduous trees being developing leaves in second half of April, most of the perennials sprout, and seeds of annual species germinate to colonize the floor, before unfavourable conditions are set by the foliage cover of the trees ensuring increased shading. Most of the low growing species which flower during April-May are soon over-

grown by taller species which grow slowly to reach their maximum development by the end of September when these flower.

Tall evergreen scrub : Well developed evergreen communities of alpine scrub are locally dominant in the zone above tree line. Taller *Rhododendron campanulatum* forms communities in the lower limit of alpine scrub zone, while dwarf evergreen scrubs extend upto the upper limit of the scrub zone. The communities dominated by *Rhododendron campanulatum* are locally common along mountain streams and on glacial deposits. The woody species commonly associated include *Syringa emodi*, *Lonicera purpurascens* and *Rosa macrophylla* var. *minor*. Several taller herbs including *Salvia hians*, *Phlomis bracteosa*, *Saussurea candolleana*, *Aster thomsonii*, *Nepeta govaniana*, *Aquilegia fragrans*, *Iris hookeriana*, and *Osmunda claytoniana*, supported by other alpine species ; *Sieversia elata*, *Anemone obtusiloba*, *Veronica melissaefolia*, etc. *Rhododendron campanulatum* communities usually pass into birch forest, and it is usual to find birch forests with good representation of this evergreen scrub.

Dwarf evergreen scrub : Dwarf evergreen scrub communities formed exclusively of *Juniperus recurva* and *Rhododendron anthopogon* often occur as large patches on the alpine slopes. Though smaller patches of either species occur distinctly, such patches are generally contagious forming continuous mixed communities. These species scarcely exceed 1 m in height, and in upper limits are often reduced to 20 cm in height. The scrub cover in this association generally exceeds 70 per cent, and in old communities these two species contribute upto 90 per cent coverage. Several taller species including *Cimicifuga foetida*, *Aquilegia fragrans*, *Rheum webbianum*, *Dipsacus mitis*, *Saussurea lappa*, *S. candolleana*, *Actaea spicata* and *Inula royleana* grow out from between these scrubs. In less dense communities, several low growing species like *Sieversia elata*,

Saxifraga diversifolia, *Fragaria vesca*, *Potentilla argyrophylla* and *Jaeschkea latisejala* lie under the scrub cover.

Parrotiopsis scrub : *Parrotiopsis jacquemontiana* forms the dominant vegetational component of the outer mountain ranges of Dachhigam reserve and covers more than 50 per cent of northeast to northwest slopes of the outer southern range, extending between 1,700 and 2,400 m in the form of pure communities.

Rosa webbiana, *Indigofera heterantha*, *Isodon plectranthoides*, *Rosa brunonii*, *R. macrophylla* var. *minor*, *Berberis lycium*, *Viburnum cotinifolium*, and *Lonicera quinquelocularis* are the usual woody associates of the *Parrotiopsis*, being present in atleast 50 per cent of the stands. Majority of the scrubs are distributed in the height classes III. The *Parrotiopsis*, which usually range in the height class IV, is significantly dominant species. Trees are poorly represented in this community in general, though these may be locally common in some stands, suggesting the invasion and gradual replacement of *Parrotiopsis*, by these trees in such stands.

Comparison of coverage curves at various altitudinal zones showed that *Parrotiopsis* gradually increases in cover contributed by it while passing higher up from its lower limit, reaching its best development at 1,900 m and then decreasing upwards, being slowly replaced by tree elements. Other scrubs, which are also well distributed at lower levels, show sharp decline with increase in *Parrotiopsis* cover. Above 1,900 m with decrease in *Parrotiopsis* cover, however, these species also show decrease being replaced tree species and mesophyll scrubs. Trees shows their prominence at upper and lower belts of *Parrotiopsis* scrub Plate 4. At lower levels, the planted tree elements escaping from the ravine and blue pine is commonly associated with *Parrotiopsis*. In upper limits *Parrotiopsis* is gradually replaced by deciduous and coniferous communities,

and it rarely forms communities dominated by it above 2,400 m, though isolated individuals of *Parrotiopsis* extend upto 2,800 m.

Being present on northern slope of the ranges, the *Parrotiopsis* scrub often passes into thorn scrub and scrub savana on opposite southerly slopes, through a narrow ecotone formed along depression or ridge between the adjacent slopes. Consideration of coverage of important woody and herbaceous species along a depression ecotone revealed that the *Parrotiopsis* shows a gradual decrease along the transition. The ecotone formed of mesophyll scrubs and dominated by *Desmodium tiliaefolium*, *Staphylea emodi*, *Berberis pachyacantha*, and *Rosa brunonii* in addition to *Parrotiopsis*, being quite rich in humus content slid down from adjacent slopes, also supports a rich growth of taller herbaceous species. The narrow ecotone turning towards southern exposure passes into deciduous thorn scrub zone dominated by *Berberis lycium*, and *Rosa webbiana*, passing above into *Chrysopogon-Themeda* dominated scrub savana. The mesophyll species which are well represented in the ecotone showed a sharp decrease towards the scrub savana. Microphyll species, on the other hand increase in the thorn scrub zone and then decrease gradually towards the scrub savana.

The herbaceous species along the transition showed a marked change. Species like *Stipa sibirica*, *Carex setigera* var. *schlagintweitiana*, *Polygonum amplexicaule*, and *Fragaria vesca*, which are well represented on humus rich soils of *Parrotiopsis* scrub and the ecotone disappear from the scrub savana, usually surviving only under the partial shade of scrubs. The dominant components of scrub savana: *Themeda anathera* and *Chrysopogon echinulatus* which together contribute more than fifty per cent coverage in this community, are almost absent from the *Parrotiopsis* scrub and the mesophyll ecotone. *Artemisia vestita*, and *Origanum normale* also showed increase, though less sharp, while passing from northern scrub towards southern scrub savana. The mesophyll scrubs of the ecotone in addition to

Polygonum amplexicaule, *Silene vulgaris*, as major components supports isolated individuals of *Dipsacus mitis*, *Heracleum candicans*, *Thalictrum minus* var. *major*, *Artemisia nilagirica*, *Lavatera cashemiriana*, etc., generally absent or poorly represented in adjacent communities.

The scrubby habit of *Parrotiopsis* with spreading branches emerging from near base, allows comparatively less herbaceous cover. A comparison of herbaceous coverage; which generally resembles the deciduous forests, at various altitudes revealed a successive lag in herbaceous activity at higher altitudes, and its concentration to warmer months. Thus, where as on lower slopes the herbs start their increased activity in March itself, the upper limits of *Parrotiopsis* scrub often start herbaceous activity in late April, but through rapid growth soon develop a rich herbaceous cover by May. There is also progressive increase of taller species at higher altitudes of *Parrotiopsis* scrub zone, being partly related to moister humus rich conditions.

Consideration of phenological sequence of the species revealed the general restriction of flowering of trees to March-May the percentage number of species flowering in March showing a decrease with altitude, in accordance with the general lag in plant activity at higher altitudes. Similar sequence is also exhibited in the scrubby species. Where as the flowering of three species is restricted to narrow range, the scrubs show a wide flowering range at lower altitudes. Herbs exhibit more wider range though the increased flowering is concentrated in May - July, especially so at higher altitudes. While higher altitudes showed a gradual decrease of flowering from summer to autumn, the lower altitudes showed a slight increase in flowering towards late autumn, probably due to restoration of spring conditions; favourable for flowering of certain species.

Though showing relative variations in cover and structure, the herbaceous components of *Parrotiopsis* scrub generally

A



B

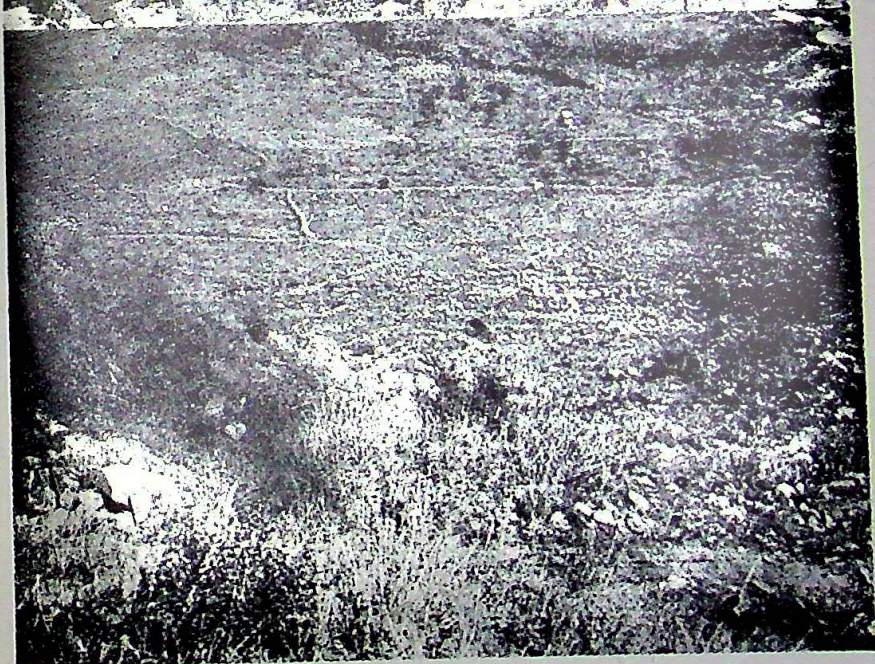


Plate 4. General landscapes:

- A. Dachhigam Sanctuary dominated by forest and scrub communities.
- B. Harwan mountain slopes dominated by matted savannas, microphyll scrubs and communities of poisonous herbs.

resemble that found in deciduous forest communities. It is partly because of the fact that both remain leafless for almost same period of year, and partly because they are developed on essentially similar slope aspects.

Deciduous thorn scrub ; Deciduous thorn scrub communities are distributed on less steeper slopes on southern aspects of the mountain ranges and are fairly common on the slopes of southern range facing towards the ravine. Lower down these slowly pass into the deciduous tree communities of the ravine. Deciduous thorn scrub communities often form ecotone between scrub savana and *Parrotiopsis* scrub; scrub savana and blue pine forest and occur in the form of narrow strips. Large stands of thorn scrub occur on the northern range, on broad outflanked gulleys, the 'Nar' and 'Khal'.

A general analysis of thorn scrub communities revealed *Rosa webbiana*, *R. brunonii*, and *Berberis lycium* to be the dominant species. Deciduous tree species especially *Prunus cerasifera*, *P. armeniaca*, *Euonymus hamiltonianus*, *E. fimbriatus* occur as isolated individuals in such communities. *Isodon placitranthoides* a dominant component of the slopes out side the sanctuary, and *Parrotiopsis* dominating the northern slopes on outer ranges of Dachhigam reserve, occur distributed to varying degrees. The scrub species are usually associated areas and humus rich soils, the prominent ones being *Geum urbanum*, *Artemisia nilagirica*, *Stipa sibirica*, *Dipsacus mitis*, *Geranium pratense* and *Arabis auriculata*.

The deciduous thorn scrub slopes being quite warmer and better illuminated and having good moisture content from winter precipitation, support, several spring flowering species including *Erophila verna*, *Taraxacum officinale*, *Colchicum luteum*, *Dactylis glomerata*, and *Arabis auriculata*. Shade loving species like *Potentilla reptans*, *Fragaria vesca*, *Geum urbanum*, *Taraxacum officinale*, *Oxalis corniculata*, and *Clinopodium* are restricted under the scrub shade, and continue a longer vegetative life.

A high vegetative cover in the thorn scrub communities, as compared to forests and *Parrotiopsis* scrub is attributed to better illumination, warmer exposure, less density of scrub branches, enabling good herbaceous growth, especially of tufted grasses. Though the real impetus to growth comes from early heat of march, a few species assimilate, though to lesser degree, even in winter months. The increased growth stimulus in spring months allows the sharp shift of individuals from height class I to II, and after partial exhaustion of growth water the growth rate of herbs in general follows a gradual course, till cessation of growth in autumn brings the herbaceous line in the height class I. A general comparison with the deciduous forest communities revealed general stunted growth of the herbaceous vegetation, only a small percentage of species ever crossing 1 m mark: towards the end of growth period in September-October.

Scrub savana: Scrub savana communities, dominated by tufted grasses *Chrysopogon echinulatus*, *Themeda anathera*, *Koeleria cristata*, and *Muhlenbergia huegelli* are present on more steeper slopes of the sanctuary facing southeast, south to southwest, especially in the outer ranges. The scrubs commonly associated on most lower altitudes include thorn with microphyll scrubs including *Cotoneaster racemiflora*, *Indigofera heterantha*, *Zizyphus jujuba* and *Lonicera quinquelocularis*.

Being devoid of close tree canopy, the thorn scrubs and most other scrubby species attain their best development in deciduous thorn scrub communities and most of these which normally scarcely reach the upper limits of height class III in forests are distributed in the height class IV in this community.

The distribution of woody and herbaceous species in thorn scrub communities influenced by slope characteristics. The ecotone thorn scrub communities which occur in the form of narrow strips and are usually situated on more steeper slopes, have the usual association of scrub savana and mesophyll species and elements of ravine are largely lacking. The distribution of herbaceous species is more local. The scrub savana species *Themeda anathera*, *Chrysopogon echinulatus*, occur on exposed gro-

und and mesophyll ones : *Fragaria vesca*, *Polygonum amplexicaule*, etc., are distributed locally under the scrubs. The thorn scrub communities on outflanked gulleys (the 'Nar' and 'Khal') which are distributed on more gradual slopes have the association of several deciduous tree species of ravine including *Prunus armeniaca*, *P. cerasifera*, and *Morus alba*, though these occur as isolated individuals contributing very small coverage. The herbaceous species in addition to *Chrysopogon echinulatus*, *Themeda anathera*, *Origanum normale*, and *Artemisia vestita* as the usual components of thorn scrub communities, include several species of shaded scrubs and microphyll scrubs.

An analysis of herbaceous components of 13 scrub savana stands, between 1,700 and 2,400 m altitudes revealed that *Chrysopogon echinulatus*, *Themeda anathera*, *Origanum normale*, and *Artemisia vestita* are invariably present together contributing 70.1 per cent of I V I, on an average. These tufted species with massive rootstocks are best suited to survive on dry southerly slopes during warm dry periods of the year. Other herbaceous species commonly present in scrub savanas include *Koeleria cristata*, *Saussurea albescence*, *Galium verum*, *Euphorbia pilosa*, and *Carex setigera* var. *schlagintweitiana* though these contribute very small coverage, and are locally common. More exposed dry areas support *Onosoma hispidum*, *Bupleurum falcatum*, *Nepeta linearis*, *Serratula pallida*, etc., while the slopes less southwards have *Carex setigera* var. *schlaqintwetiana*, *Koeleria cristata*, *Muhlenbergia hugelii*, *Lychnis coronaria*, etc., as locally common.

Consideration of the woody species in scrub savana revealed the striking scarcity of tree species. Thorn scrubs *Rosa webbiana*, *Berberis lycium*, *Rosa brunonii*, and microphyll scrubs *Cotoneastr racemiflora*, *Indigofera heterantha*, *Lonicera quinquelocularis*, and *Isodon plectranthoides* are the usual associates in scrub savanas, though none on average forms more than five per cent coverage. *Rosa webbiana*, *Berberis lycium* and *Indigofera heterantha*, however, are locally common in some strands, often having more than ten per cent coverage. Though rarer in such communities, the tree species to be found include *Euonymus*

fimbriatus, *Prunus armeniaca*, *P. cerasifera*, and *Pinus griffithii*, especially at lower levels.

The seasonal pattern of herbaceous cover revealed the dominance of species distributed in height classes II and III a. The area being dominated by tufted perennials having massive rootstocks, they reach their maximum height in late summer. Majority of the taller species expecting few early ones like *Ferula jaeschkeana*, *Thalictrum minus* var. *major*, and *Polygonum alpinum*, reach their maximum development during September-October to start their reproduction. A comparison of the seasonal pattern with a scrub savana of the ravine revealed a lag in vegetative activity at higher altitudes. The increased herbaceous activity in scrub savanas starts in early part of March, with successive lag at higher altitudes, but as the species soon cross the I height class, and due to scarcity of low growing and creeping species in scrub savanas, height class I is poorly represented for major part of the year.

Broad leaved herb communities : *Sambucus wightiana*, one of the most abundant herbaceous species of Kashmir valley, forms narrow belts of communities dominated by it along the pathways on the borders of the sanctuary. The usual herbaceous component in *Sambucus wightiana* community is poisonous *Stipa sibirica* supported by *Origunum normale* and *Artemisia vestita* at lower levels and *A. nilagirica* at upper levels. The *Sambucus wightiana* communities range between 2,300 and 2,900 m.

Smaller communities of broad leaved herb, dominated by *Osmunda claytoniana* and *Iris hookeriana* are distributed in the levels of alpine pastures, with usual association of *Sieversia elata*, *Anemone obtusiloba*, *Stachys sericea* and *Veronica melissaeifolia*. The alpine pastures are, however, dominated by broad leaved matted herb species like *Sibbaldia cuneata*, *Sieversia elata*, *Anaphalis nepalensis*, and *Anemone obtusiloba*, as contrast the matted pastures of lower altitudes which are dominated by grasses.

Dachhigam ravine

The ravine formed between adjacent mountain ranges ext-

ends from near Harwan reservoir, where it is broadest, and narrows towards Draphom. It has the lowest point in Harwan reservoir (1,680 m) and shows a gradual ascent towards the Draphom (1,870 m). The main portion of the ravine, with the main stream running through it, is essentially flat, passing gradually into the northern range on one side, but sharply into the southern range on the other side. Artificial barriers separate it from the Harwan-New Thir valley towards the west. The ravine shows a mixture of planted elements : having become naturalised since the area was declared as a sanctuary, and the natural elements migrated down from the adjacent slopes and perpetuated over the period of half a century.

***Robinia pseudoacacia* community :** Though no well defined communities of *Robinia pseudoacacia* are developed, yet the rapid propagation through suckers ensures small stands of this species distributed in the ravine, especially along roadsides. It invades the forest openings and through rapid colonization forms close stands; suggesting why taller tree species are usually lacking from *Robinia pseudoacacia* community. The rapid colonization of this species is reflected in occurrence of its individuals in all height classes, though the major distribution occurs in the upper most height class. The common associates in this community include *Lonicera quinquelocularis*, *Crataegus monogyna*, *Rubus antennifer*, *Indigofera heterantha*, *Rosa webbiana*, *Celtis caucasica*, etc., but these species show very starved growth; being largely distributed in height class II and III a, and contribute very small coverage. The stratification is very poorly developed in this community, except for that formed by the individuals of *Robinia pseudoacacia* itself, as reflected in stem diameters and crown diameters of individuals in various height classes, comes light through comparison with the individuals of this species growing in scrub savana. The latter showed better development of both crown and stem, the effect being well marked in upper height classes. The closing in of top canopy results both in the reduction of crown diameter and bole of the individuals of *Robinia pseudoacacia*. The differences are marked in the younger individuals which tax upon the suckers

of the main tree and have reduced requirements, though reduced illumination has some effect on development of branches and stem diameter.

The herbaceous cover in *Robinia pseudoacacia* community is also markedly reduced, the total herbaceous cover rarely being more than 20 per cent in a close community. Most of the herbaceous species growing in this community are low growing or creeping species like *Viola odorata*, *Ophioglossum vulgatum*, *Fragaria vesca*, *Potentilla reptans*, and *Clinopodium umbrosum*. The community receives some amount of illumination in winter and spring when the trees are naked, allowing the concentration of flowering of most of these herbaceous species in spring, passing rest of the year in vegetative or perennating condition. Some taller species, however, grow slowly to reach their reproductive phase in autumn. These taller species include *Siegesbeckia orientalis*, *Carpesium cernuum*, *Urtica dioica*, *Myriactis nepalensis*, and *Picris hieracoides*.

The closing in of *Robinia pseudocacia* also results in marked reduction in the reproductive capacity of the associated species; and while as certain species like *Daphne oleoides*, *Prunus cerasifera* are rarely able to reproduce in *Robinia pseudoacacia* community, others, including *Rosa webbiana*, *R. brunonii*, *Indigofera heterantha*, and *Lonicera quinquelocularis* have very poor production of flowers and fruits, evidently related to poor vegetative growth of species under poor light and increased competition with the massive rootsystem of *Robinia pseudoacacia*.

Salix alba plantation : Though cultivated species of *Salix* : *S. alba*, *S. babylonica*, and *S. caprea*, with male plants only are unable to propagate under natural conditions, and never form natural communities, yet these are well represented in Dachhigam ravine. The left out saplings of these species, especially *S. alba*, and plantations on more humid situations in ravine since the area was declared as a sanctuary have formed the stands of *Salix*, with modification of under strata.

The *Salix* plantations along Harwan reservoir being dominated by *S. alba*, have frequent inundations of floor from the

reservoir water and as such the associated woody species are scarce. Only scrubby species growing under such a plantation include the species of *Rubus*, and *Rosa webbiana*, contributing very small coverage. Natural regeneration of tree canopy being absent, the stratification is very poor in such a plantation. The herbaceous cover is well developed, being largely composed of swampy and marshy species like *Phalaris arundinacea*, *Polygonum nepalense*, *Carex foliosa*, *C. psychrophila*, *Myosotis caespitosa*, *Polypogon fugax*, etc., the best developed herbaceous coverage in July often being more than seventy per cent. Shade loving species like *Taraxacum officinale*, *Prunella vulgaris*, *Potentilla reptans*, and *Geranium nepalense* are locally dominant in exposed areas towards the ravine, not usually covered by water.

The plantations of *Salix alba* along the borders of ravine towards rice fields, and on recently enclosed areas, are less dense and being developed on less watery habitat have well development of associated woody species (Table 3). Isolated trees of *Rhus succedanea*, *Prunus cerasifera*, *Celtis caucasica*, and *Morus alba* are distributed in the main tree canopy. *Rosa brunonii* forms the dominant scrubby stratum: largely overshadowing other scrubs by its spreading scandent habit. *Isodon plectranthoides*, *Rubus niveus* are other important woody species and these together with *Rosa brunonii*, other scrubs and trees form very well developed stratification. The floor, however, is considerably shaded and allows only a sparse cover usually formed by shade loving species like *Viola odorata*, *Geranium nepalense*, *Potentilla reptans*, *Ophioglossum*, *Sigesbeckia orientalis*, *Carpesium cernuum*, and *Clinopodium umbrosum*, though the small openings often have rich herbaceous cover of grasses.

***Morus alba* community :** *Morus alba* is one of the more commonly distributed species of Dachhigam ravine, being supported by excessive propagation by seeds. This together with the establishment of planted individuals during this half a century (since the area was declared as a sanctuary) has resulted in close communities of this species often contributing more than 70 per cent coverage. The broad dense crown of *Morus alba* ensures

Table 3. Coverage and height range of woody species in a road side *Salix* plantation in Dachhigam ravine.

Species	Coverage (%)	Principal height class range
<i>Salix alba</i>	46.4	VI
<i>Rosa brunonii</i>	29.3	IV
<i>Salix babylonica</i>	11.2	VI
<i>Rubus antennifer</i>	8.1	II-III
<i>R. niveus</i>	5.3	III
<i>Prunus cerasifera</i>	5.1	III-IV
<i>Isodon plectranthoides</i>	5.1	II-III
<i>Indigofera heterantha</i>	3.7	III
<i>Morus alba</i>	3.6	V-VI
<i>Rubus ulmifolius</i>	3.6	III
<i>Prunus armeniaca</i>	3.5	VI
<i>Rosa webbiana</i>	3.5	III
<i>Jasminum humile</i>	3.4	III
<i>Lonicera quiquelocularis</i>	3.1	III-IV
<i>Rhus succedanea</i>	3.1	V-VI
<i>Clematis grata</i>	2.9	III-IV
<i>Viburnum continifolium</i>	2.7	III-IV
<i>Celtis caucasica</i>	2.4	V
<i>Berberis lycium</i>	2.4	II-III
<i>Elaeagnus umbellata</i>	2.3	III
<i>Prunus tomentosa</i>	2.2	III-IV
<i>Ulmus villosa</i>	1.4	III-IV

dense shading of floor and consequent reduction in stratification, though tree species like *Rhus succedanea*, *Celtis caucasica*, and vines *Vitis vinifera*, and *Hedera nepalensis* reach the principal tree canopy and survive better. The scrubs, generally the same species as found in *Robinia pseudoacacia* community, likewise have poor development, contributing more than five per cent coverage. Among the more commoner scrubs in *Morus alba* community include *Rosa brunonii*, *Rubus antennifer*, and *Viburnum cotonifolium*. Most of the scrubs being distributed in height classes II and III, the stratification is very poor.

Considerable shading in *Morus alba* community, has similar effect of reduction of reproductive capacity of species, the effect being more deteriorating than in *Robinia pseudoacacia* commu-

nity, though small openings allow luxuriant growth and reduction of scrubs.

The herbaceous cover in *Morus alba* community is also poorly developed; in closer communities with more than 70 per cent tree cover, it scarcely covers more than 30 per cent of the ground floor in July. The herbaceous species, as is true for the *Robinia pseudoacacia* community, include mostly the low growing and creeping spring flowering species, and taller autumn flowering species. Taller herb *Solenanthes cercinatis*, and *Geum urbanum*, are however, well represented in *Morus alba* community in spring and early summer supported by partial illumination through naked trees. The former species is often locally common forming close patches, though being short lived.

The seasonal pattern of herbaceous cover revealed general scarcity of herbaceous cover in all height classes. though there is sudden increase in height class IIIa in April - May due to rapid growth and short life span of *Solenanthes cercinatis*. There is general restriction of species into the height class II in the months of July-September, accompanied by slight decrease in coverage of height class I, as is also true for *Robinia pseudoacacia* community. The consideration of flowering potentialities revealed two peaks one in March and another in September. There is, however, general reduction of flowering, only a small percentage of individuals flowering, despite small increase in March and September. The initial warming up of floor supported by leafless tree canopy allows the first phase of increased flowering in March, of most of the low growing perennials, while as the taller annuals like *Siegesbeckia orientalis*, *Carpesium cernuum*, *Myriactis nepalensis*, *Cynoglossum glochidiatum*, etc., growing slowly to flower in second phase of increased flowering in September.

Deciduous thorn scrub: Well developed communities of thorn scrubs, dominated by *Rosa brunonii* and supported by *Rosa webbiana*, *Berberis lycium*, and *Rubus antennifer* are common in forest openings with isolated trees of *Morus alba*, *Prunus armeniaca*, *Celtis caucasica*, *Rhus succedanea*, *Salix alba*, etc., in the proces of colonization. Usual scrubby associates include *Indigofera heterantha*, *Rubus niveus*, *Isodon plectranthoides*, *Prunus cerasifera*, *Jasminum*

humile, and *Lonicera quinquelocularis*. The stratification is well developed in thorn scrub communities, better illumination allowing gregarious growth of scrubs, the majority of these which are usually distributed in II and III height classes in forest communities often reach height class IV in this community. While as the tufted grasses like *Themeda anthera*, *Chrysopogon echinulatus*, *Agropyron semicostatum*, *Stipa sibirica*, and broad leaved herbs like *Artemisia vestita*, *Origanum normale*, *Agrimonia pilosa* and *Trifolium pratense* are commoner in openings between scrubs, the shaded floor below scrubs characteristically supports shade loving species *Oxalis corniculata*, *Fragaria vesca*, *Ranunculus distans*, *Galium gilanicum*, *Potentilla reptans*, *Clinopodium umbrosum*, etc.

The seasonal pattern of herbaceous cover revealed the general restriction of height class I in spring and late autumn, the higher classes being better represented in summer and early autumn. The general restriction of height class III to September is ensured through tufted perennial species which reach their maximum development in August-September. As compared to the communities of the mountain slopes some amount of herbaceous activity is to be found in winter months also, ensured through slightly higher temperatures in the ravine.

Scrub savana : Herbaceous communities dominated by tufted grasses: *Chrysopogon echinulatus*, *Themeda anthera*, *Bothriochloa pertusa*, and *Stipa sibirica* with isolated scrubs, occur in openings especially in outer regions of Dachhigam ravine near Harwan reservoir, and the foothills of the northern range. Broad leaved herbs *Origanum normale*, *Artemisia vestita*, *Plantago lanceolata*, *Medicago lupulina*, are universally associated in these communities. In striking contrast to the scrub savanas of mountain ranges, the scrub savanas of ravine have good association of annuals and biennials like *Poa annua*, *Bromus japonicus*, *Medicago minima*, *Avena fatua*, *Aegilops tauschii*, *Tragopogon kashmiranus*, *Bromus mollis*, *Crepis sancta* Ssp. *bifida*, *Erodium cicutarium*, etc., in spring and early summer.

The scrubby species, which rarely form more than 20 per cent coverage in scrub savana are largely represented by the

components of thorn scrub communities, *Indigofera heterantha*, *Rosa webbiana*, *Berberis lycium*, *Isodon plectranthoides*, and *Rubus niveus* being more commoner. Tree species *Morus alba*, *Robinia pseudoacacia*, *Prunus armeniaca*, *Rhus succedanea*, etc., occur as isolated individuals contributing very small coverage. Open scrub savana communities ensure gregarious growth of tree species as well as the scrubs, majority of scrubby species reaching height class IV, as is also true for their performance in thorn scrub communities.

The open canopies of scrub savanas also ensure increased reproductive potentialities of the species. The results are quite marked in scrubs as compared to their performance in tree communities (Table 32), showing ten to thirty times increase in flowering and fruiting potentialities of *Rosa webbiana*, *R. brunonii*, *Berberis lycium*, and *Indigofera heterantha* in former, evidently related to gregarious growth afforded by less competition and good illumination in scrub savana communities.

Seasonal pattern of herbaceous cover is essentially related to thorn scrub communities, though there is marked reduction of height class I in summer and its increased restriction to spring and late autumn. Summer months showed considerable increase in coverage of height classes II and III, the latter as usual reaching its maximum in autumn. Communities being largely represented by perennials; and annual species being mainly restricted to March-May, the seasonal pattern of herbaceous cover suggests the scarcity of low growing species, and predominance of taller species, mostly situated in height classes II and IIIa during their best development.

Stream side vegetation : A dense belt of vegetation, as is generally true for such areas, borders the main stream running through the ravine. Though woody composition is essentially similar to that found elsewhere in ravine, *Ulmus villosa*, *Populus ciliata*, *Salix caprea*, include the characteristic species of this belt. Sacandent scrubs *Rosa brunonii*, *Rubus niveus*, *R. antennifer*, *Clematis grata*, together with *Berberis lycium*, *Lonicera quinquelocularis*, *Indigofera heterantha*, etc., dominate this belt, shaded over in addition to above tree species by usual tree com-

ponents of the ravine. Among the characteristic herbaceous species include *Phalaris arundinacea*, *Impatiens glanduligera*, *Phragmites communis*, *Epilobium hirsutum*, *E. cylindricum*, *Geranium nepalense*, *G. pratense*, *Dipsacus mitis*, and *Rumex patientia* Ssp. *orientalis*.

Roadside desert herbs : Construction of road through the ravine, leading upto Draphom, has formed the narrow belts of desert herb along northern side of the main stream. This belt with isolated individuals of *Verbascum thapsus*, *Scrophularia polyantha*, *Onosoma hispidum*, *Ajuga remota*, have usual concentration of ephemeral herbs *Poa annua*, *Bromus japonicus*, *B. mollis*, *Vulpia myuros*, etc., in early part of the year.

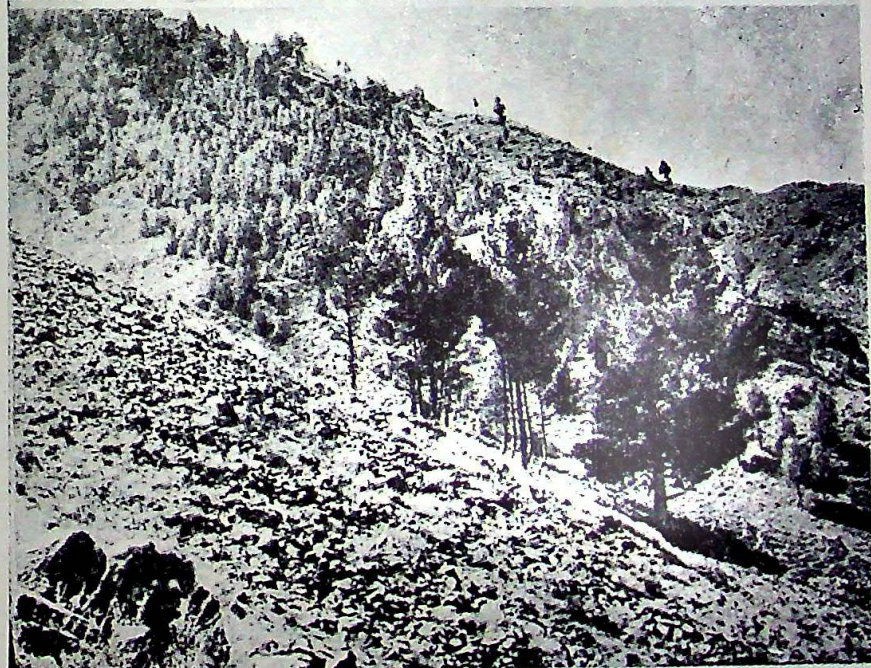
Harwan mountain slopes

The mountain slopes outside the sanctuary, and overlying the villages from near Harwan to Shalimar, depict the influence of human interference on vegetation. Except for the blue pine, the natural tree elements are lacking, though foothills are planted with species of *Populus*, *Salix*, *Prunus*, etc., and are gradually enclosed for cultivation. The less steeper slopes, especially at lower altitudes through excessive grazing, lopping and trampling, have been developed into matted savanas (pastures), while steeper ones support some scrubby and tall herbeceous communities. Excessive grazing on steeper slopes at lower altitudes have developed them into desert scrub and desert herb communities with sparse plant cover.

Blue Pine forest : Isolated communities of blue pine are distributed on steeper slopes towards the top of southern range, and have minimised human access. The general composition and structure of these communities is essentially similar to those found in the sanctuary, with prominence of shade loving species : *Bergenia ciliata*, *Valeriana wallichii*, *Prenanthes brunoniana*, *Dactylis glomerata*, etc., though broad leaved trees associates are generally lacking. The lower level blue pine community, being closer to the village and subjected to considerable grazing and associated effects Plate 5 has poorly developed stratification. The woody cover of scrubs is very poor, that too formed by armed scrubs : *Rosa webbiana*

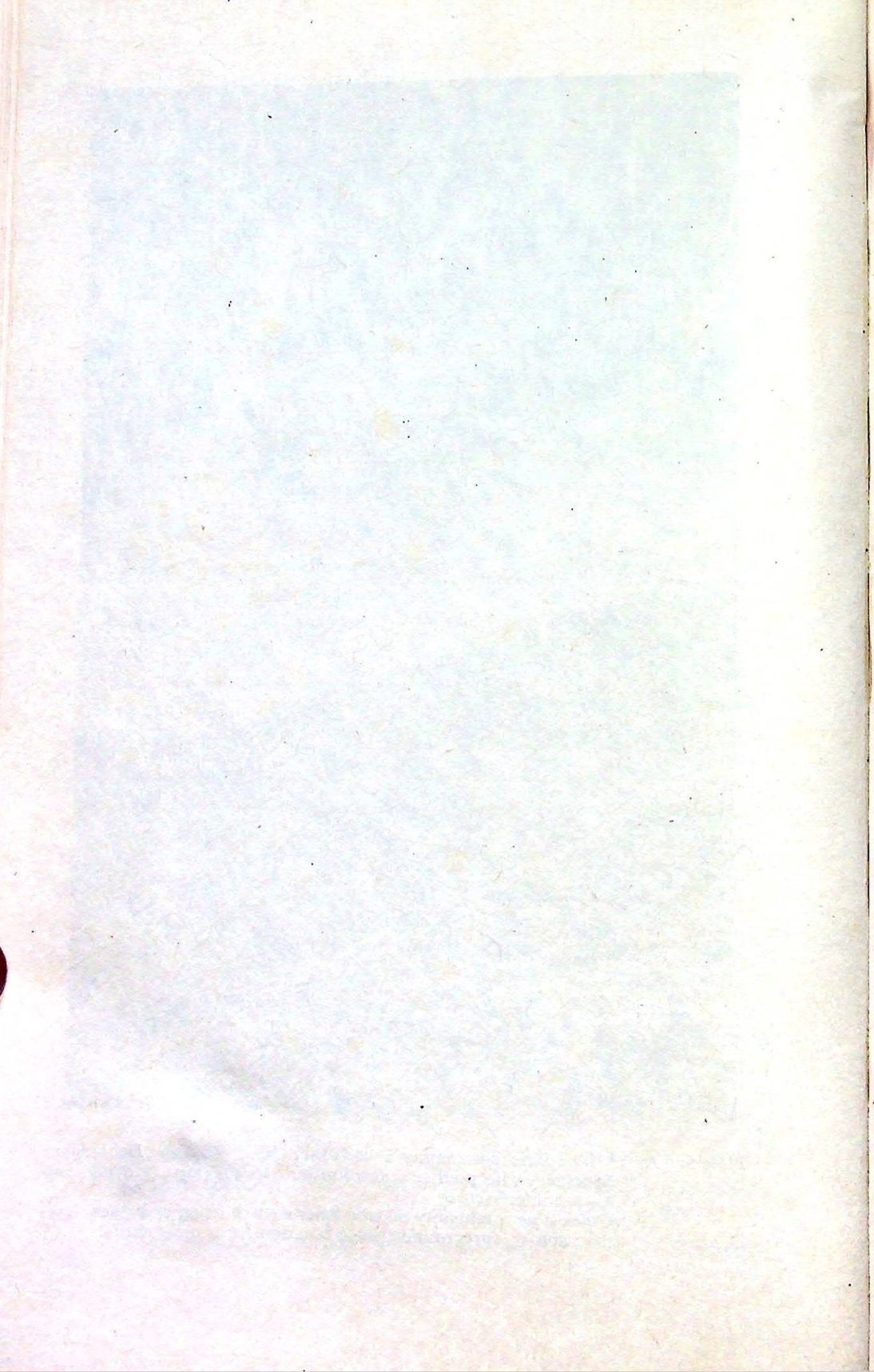


A



B

Plate 5. A. A blue pine community at a lower level outside Dachhigam Sanctuary with poor stratification due to excessive grazing and human interference.
 B. A blue pine community outside Sanctuary but at a higher level than above; foreground eroded boulders from rocky cliffs.



Berberis lycium, *B. psuedoumbellata*, and *Juniperus communis* and being protected from browsing and trampling. The scrubs show very stunted growth due to mixed biotic influences and close tree canopy of blue pine. That, this influence decreases successively at higher levels, being distant from the habitation below and on more steeper slopes, is reflected in better stratification at higher levels as compared to lower level blue pine community.

The growth of the species is also affected. Thus, whereas the scrubby species rarely exceed 50 cm mark at lower levels a higher level blue pine community has almost all scrubs distributed above that mark: in height class III. The scrubby coverage is also markedly increased.

The herbaceous species are most affected by grazing and trampling. At lower levels the herbaceous cover, except for taller poisonous *Stipa sibirica*, is exclusively composed of low growing and creeping matted species; consequently the height class I is dominant throughout the year. Higher up, though some low growing species are present, the taller ones are dominant, being largely the poisonous species. That, species reach their maximum development in autumn is reflected in concentration of higher height classes towards later months of the year.

Phenological considerations of blue pine forest revealed the major concentration of flowering during July-September. However, there was considerable reduction of flowering in excessively grazed communities at lower levels, the flowering percentages increasing at upper levels with concentration towards summer months. As is general for other communities, the higher levels exhibited lag in flowering.

Deciduous microphyll scrub: While most of the gradual slopes of Harwan mountain range are dominated by matted grasses, the steeper slopes on northeastern, northern, and north-western slopes are generally dominated by microphyll scrub *Isodon plectranthoides*. On Harwan mountain slopes, these communities descend down to 1,800 m from the top of the

range. A consideration of data taken from 18 microphyll stands between 1,800 m and 2,400 revealed that *Isodon plectranthoides*, on an average contributed 50 per cent of I V I. Though different stands differ in the percentage cover formed by *Isodon plectranthoides*, the average coverage by this species approximated 43 per cent. Though other scrubby species are poorly represented in microphyll communities, *Rosa webbiana*, *Berberis lycium*, *Indigofera heterantha*, and *Spiraea canascens* are the usual associates being present in more than 50 per cent of the stands, though these contribute very small coverage. More northerly slopes have mesophyll species *Parrotiopsis jacquemontiana*, and *Viburnum cotinifolium*. Isolated young individuals of *Pinus griffithii* are met with, especially where the mature individuals of this species are at hand.

The sequence of biotic influence on disappearance of *Isodon plectranthoides* from the matted scrub savana towards lower levels of slopes, is reflected from the consideration of crown diameters and height of this species along an uphill transition from matted scrub savana to microphyll *Isodon plectranthoides* scrub. This species is very poorly represented; with stunted individuals due to excessive grazing and trampling, on gradual slopes of scrub savana. Passing above the density of this species increases until the communities formed by it are reached. In successive higher altitudinal levels of scrub savana the height and crown diameter showed gradual increase; the increase being sharp in transition belt dominated by *Stipa sibirica*. In the microphyll scrub zone after some initial increase, the value for both crown diameter and height, become more or less uniform. A comparison of the two communities revealed that in the matted scrub savana the crown diameters and the height of *Isodon plectranthoides* are often reduced five times from their usual growth in microphyll scrub communities.

Though average growth of *Isodon plectranthoides* in its communities at various altitudes is slightly effected, there is successive lag in initiation of vegetative activity of this species at higher altitudes. Thus with every 100 m increase

in altitude, there is average lag of 5.4 days in initiation of leaves. Local topographic variations, however, modify this relationship; northeast and northwest aspects starting their activity earlier than the northern aspects. Consideration of altitudinal lag in *Fritillaria imperialis* also presented comparable results showing an average lag of 5.3 day in emergence of leaves with every 100 m altitudinal increase, also subjected to local topographic variations. The successive reduction of interval between emergence of leaves and flowering at higher altitudes is evidently related to the shift to warmer periods of the year at higher levels, ensured through the vegetative lag.

There is considerable grazing, trampling, and disturbances of soil in microphyll scrub, resulting in large absence of tufted forage grasses; poisonous *Stipa sibirica*, *Atrémisia vestita*, and *Origanum normale* being the major herbaceous components. Good moisture content from winter precipitation, disturbed soil, scarce herbaceous cover and early warming up in spring allows a rich growth of short lived perennials like *Fritillaria imperialis*, *Ferula jaeschkeana*, *Allium atropurpureum*, *Colchicum luteum*, and annuals including *Bromus japonicus*, *B. barobaliana*, *Poa annua*, *Stellaria media*, *Phleum graecum*, *Veronica persica*, *V. stewartii*, *Galium gilanicum*, *G. parisiensis* Ssp. *anglicum*, *Vulpia myuros*, *Erophila verna*, *Holosteum umbellata*, etc. These complete their life cycle before drier conditions set in and cattle invade these communities. For major part of the year, the floor, except for poisonous species, is generally barren. There is, thus, general restriction of herbaceous activity during March-April though the successive lag at higher levels shifts this concentrated activity towards April-May. Poisonous perennials, however, grow slowly to reach their maximum development towards late summer; and as such higher height classes are restricted towards August-September. The upper limits of microphyll scrub, in addition to these poisonous species and epimerals, have taller short lived species like *Polygonum alpinum*, *Thalictrum minus* var. *major*, *Aquilegia fragrans*, *Impatiens thomsoni*, *Valeriana wallichii*, *V. hradwickii*, etc. which ensure their good representation in higher height classes during May-June also.

The consideration of phenological sequence presented comparable results. Two peaks of flowering; one in April shifting towards May with lag at higher altitudes, and another in September are observed in microphyll *Isodon plectranthroides* scrub. The highest peak formed in April is ensured through fast reproducing short lived species, while taller poisonous perennials together with *Isodon plectranthoides* flowering largely in September form the second peak.

Excellent illumination, afforded through scrubby, rich humus content in these communities, supported by initially better moisture content and disturbed soil, ensures the increased flowering percentages in microphyll scrub, due to prominence of annuals, as compared to forest and matted scrub savana communities.

Deciduous thorn scrub: Deciduous thorn scrub communities are rarer in the area, being replaced by desert scrub communities. A few thorn scrub communities, however, occur on steeper northwest to southwest slopes at lower altitudes of Harwan ranges. *Rosa webbiiana*, and *Berberis lycium* are the dominant components supported by poisonous herbs *Stipa sibirica*, *Artemisia vestita*, and *Origanum normale*. The usual for grasses *Chrysopogon echinulatus*, and *Themeda anathera* which dominate the herbaceous cover in thorn scrub communities of Dachhigam reserve, are almost absent. The floor is, however, temporarily covered by ephemerals like *Phleum paniculatum*, *Medicago minima*, *Arenaria serpyllifolia*, *Torilis nodosa*, *Erodium cicutarium*, *Gerauium rotundifolium*, and *Filago spathulata*, in spring. The soil being drier and poorer in humus, the taller species of microphyll scrubs are largely lacking; though shaded below the scrubs occur shade loving species *Oxalis corniculata*, *Galium gilanicum*, *Fragaria vesca*, *Taraxacum officinale*, etc. Other scrubs are generally lacking, though isolated individuals of *Cotoneaster racemiflora*, *Indigofera heterantha*, *Astragalus grahamianns*, and *Isodon plectranthoides* are meth with.

Tall scrub savana: Steeper slopes on northerly aspects of rocky cliffs are often dominated by taller grasses *Stipa*

sibirica, and *Poa stewartiana* with isolated individuals of scrubs including *Isodon plectranthoides*, *Rosa webbiana*, *Jasminum humile*, *J. officinale*, *Spiraea canescens*, *Viburnum cotinifolium*, etc. These grasses are very well represented, often covering more than 70 per cent of the ground, although short lived perennials like *Fritillaria imperialis*, *Allium atropurpureum*, *Ferula jaeschkeana*, *Corydalis diphylla*, and *Mertensia exserta* are well represented, the annual ephemerals being locally common. Though subjected to less grazing, yet being present on northerly aspects these communities have poor representation of *Themeda anathera*, and *Chrysopogon echinulatus*, the dominant components of tall scrub savanas of Dachhigam reserve developed on southerly aspects. Moisture loving species *Bergenia ciliata*, *Fragaria vesca*, *Carex setigera* var. *schlaginweitiana*, *Valeriana stracheyi* and *Asparagus filicinus*, are the usual associates in this community.

Though southerly aspects of rocky cliffs are generally developed into desert scrub communities due to grazing and lopping effects and low moisture content, the steeper slopes not accessible for grazing have scrub savana communities dominated by *Themeda anathera* and *Chrysopogon echinulatus*, as also found on most southerly slopes of Dachhigam reserve. Such slopes, however, have poor representation of *Origanum normale* and *Stipa sibirica*, as also the *Artemisia vestita*: the poisonous species.

Tall scrub savana communities on northern aspects pass lower down into microphyll *Isodon plectranthoides* scrub, the poisonous species being well associated in the transition zone. In early part of the year, *Fritillaria imperialis* is abundant in this transition zone and extends into the microphyll scrub community and seasonal broad leaved herb communities.

Narrow belts of tall scrub savana are also formed along the transition from matted scrub savana to microphyll scrub. These are dominated by *Stipa sibirica*, and have the usual association of broad leaved herbs *Artemisia vestita*, and *Origanum normale*.

Matted scrub savana and matted grasslands : Though distinct communities of matted grassland (pastures) and matted scrub savana are developed on Harwan mountain slopes, yet the two pass insensibly into each other, the latter being higher on the slopes (Plate 6). Following up along a uniform mountain slope, the matted grasslands are associated with and show gradual increase in scrub components: usually *Berberis lycium*, *Isodon plectranthoides* and *Rosa webbiana*. The matted scrub savana at upper levels has increased association of *Stipa sibirica*, *Isodon plectranthoides*, *Artemisia vestita*, and *Origanum normale*. Along the northern shift higher up the tall scrub savanas are usually replaced by microphyll *Isodon* scrub, while along the southern shift these pass into desert herb and desert scrub communities.

Matted savanas are invariably dominated *Cynodon dactylon* *Bothriochloa pertusa*, together contributing more than 50 per cent coverage, on an average, being best adapted to survive the grazing effects through their low matted habit and efficient vegetative proliferation. Rosette forming *Plantago lanceolata* is invariably present in these communities. A few species that come into the composition of matted savana include low growing or creeping perennials: the usual associates being *Medicago lupulina*, *Oxalis corniculata*, *Taraxacum officinale*, and *Trifolium repens*. Only taller species that survive in this community include poisonous *Stipa sibirica*, *Euphorbia helioscopia*, *Marrubium vulgare*, and *Artemisia vestita*, though lower altitudes have local association of armed herb *Centaurea iberica*.

The effect of grazing and trampling on vegetation of matted savana is largely reflected from a comparison with the savanas enclosed by local people for future cultivation. The major components *Cynodon dactylon* and *Bothriochloa pertusa* were twice and thrice taller, respectively, in savana enclosed for four years, as compared to exposed savana in August (Table 49), and each showed nearly ten times increase in flowering in enclosed savana. Similar increase was also observed in the case of *Centaurea iberica* though less marked due to protective armature of this species. Though annual species are very poorly repre-

sented in exposed matted savanas, they are better represented in the enclosed savanas, the more common species being *Galium parisiense* Ssp. *anglicum*, *Arenaria serpyllifolia*, *Trifolium dubium*, *Cerastium glomeratum*, *Erodium cicutarium*, and *Vulpia myuros*.

The matted scrub savanas have the essential composition of matted savanas and the two are often contagious, the former distinguished by the association of isolated individuals of scrubs: *Isodon plectranthoides*, *Berberis lycium*, and *Rosa webbiana* (Table 50). The dominant herbs *Cynodon dactylon*, and *Bothriochloa pertusa* together, on an average contributing 40 per cent coverage, show decrease towards upper limits. There is increased association of *Stipa sibirica*, *Artemisia vestita*, and *Origanum normale*. The annuals also increase in prominence. Towards the southerly borders, there is usually the association of *Thymus serpyllum*, while the borders with northerly aspects have increased association of *Trifolium repens*, *Duschnea indica*, *Fragaria vesca*, etc.

Consideration of the sequence of our important species: *Cynodon dactylon* and *Bothriochloa pertusa*, the dominant component of matted savanas and matted scrub savanas; *Isodon plectranthoides*, the dominant component of microphyll scrub; and *Stipa sibirica*, the dominant component of tall scrub savanas and major associate of microphyll scrub, along an uphill transition along northwest aspect from matted savana to microphyll scrub, through matted scrub savana and tall scrub savana, presented comparable results. Both *Cynodon dactylon* and *Bothriochloa pertusa* exhibited a gradual decrease in coverage contributed, from matted savana to matted scrub savana; but with a shift towards tall scrub savana there is sharp decrease in both these species, disappearing upwards towards microphyll scrub. *Isodon plectranthoides*, absent from matted savanas, appeared in matted scrub savana, exhibited a sharp increase through tall scrub savana, followed by a gradual increase in microphyll scrub. *Stipa sibirica*, also present in matted savana, showed a very gradual increase towards matted scrub savana, exhibiting a sharp increase through tall scrub savana;

and then gradually decreasing through the microphyll scrub and again increasing upwards. The sequence of these species in the formation of distinct communities is distinctly related to biotic interference, the matted savanas reflecting the result of extreme grazing and trampling on northerly aspects, the influence successively decreasing while passing towards microphyll scrub along the transition.

The distribution of herbaceous species along the transition from matted savana to microphyll scrub over different periods of year revealed successive increase in annual species along the transition, and their major concentration in spring months. All annual species in matted savanas and matted scrub savana are restricted to height class I, in higher level communities there being increased association of height class II annuals. The perennial species in matted savanas, continuing for major part of the year, reach their full development during August-September, and except for a few taller poisonous species which never contribute more than 5 per cent coverage, are exclusively distributed in height class I. In taller scrub savana and microphyll scrub the low growing species are poorly represented. Though taller herbs reach their full height towards late summer, a few taller short lived species *Fritillaria imperialis*, *Ferula jaeschkeana*, and *Allium atropurpureum*, reach their full development during April-May to form good representation of upper height classes in spring also.

Seasonal broad leaved herb : Small patches of humus soils on northerly aspects of steeper slopes, and often the gulleys between cliffs which are laid barren due excessive lopping and disturbances of soil have seasonal communities of broad leaved herbs with or without isolated scrubs. The dwarf communities are dominated by rich growth of species like *corydalis diphyllo*, *Stellaria media*, *Geranium lucidum*, *G. rotundifolium*, *Veronica stewartii*, *Phleum graecum*, *Arenaria serpyllifolia*, and *Galium gilanicum*, in spring. Taller herb *Fritillaria imperialis* is frequently associated in such communities. These species complete their life cycle in short period so that for major part of the year these areas are quite barren.

The tall broad leaved herb communities, present on similar slopes at higher altitudes, are dominated by *Fritillaria imperialis*, *Polygonum alpinum*, *Polygonatum verticellatum*, *Valeriana hardwickii*, *Crambe cordifolia* var. *kotschyana*, *Asparagus filicinus*, etc.; are equally concentrated towards early part of the year, rarely continuing beyond early summer. Towards summer, *Impatiens thomsonii*, *Nepeta erecta*, *Geum urbanum*, etc., form sparse cover.

Desert scrub : The southerly aspects of mountain slopes outside the sanctuary are usually rocky and subjected to considerable grazing. These have sparsely covered ground with isolated scrubs *Berberis lycium*, *Rosa webbiana*, *Isodon plectranthoides* together forming the sparse cover rarely exceeding 25 per cent. Though isolated individuals of *Oxalis corniculata*, *Clinopodium vulgare* occur below scrubs supported by some annuals in spring, the usual herbs growing in desert scrubs include poisonous species *Artemisia vestita*, *Origanum normale*, *Stipa sibirica*, etc., and distinctive creeping species like *Thymus serpyllum*, *Ajuga remota*, *Herniaria incana*, etc. A few annuals including *Phleum paniculatum*, *Erodium cicutarium*, *Filago spathulata*, *Geranium rotundifolium*, *Arenaria serpyllifolia* are sparsely distributed in spring.

Desert herb : These represent still advanced stages of biotic interference being developed on gradual southerly slopes. The characteristic desert herb species include *Thymus serpyllum*, *Plantago lanceolata*, *Ajuga remota*, *Herniaria incana*, and *Tripogon purpurascens*. These slopes are usually rocky and have poorly developed soils. Seasonal annuals usually include *Phleum paniculatum*, *Arenaria serpyllifolia*, *Euphorbia hispida*, and *Erodium cicutarium*.

Desert herb situations are also developed by land slides and erosion along mountain streams. The characteristic species included *Cynodon dactylon*, *Bothriochloa pertusa*, *Convolvulus arvensis*, *Clinopodium umbrosum*, *Lactuca seriola*, *L. dissecta*, *Poa annua*, *Potentilla reptans*, etc.

Harwan-New Thir Velley

The valley outside the sanctuary, extending between Harwan and New Thir is devoid of natural vegetation, being dominated by cultivated fields, orchards, flood plain, graveyards, and wastelands. The roadsides have mixed plantation of *Populus nigra* var. *italica*, *Platanus orientalis*, *Robinia pseudoacacia*, *Morus alba*, *Juglans regia*, etc. The streamsides are usually planted with *Salix alba*, and *S. babylonica*, though the former is more commoner. Several moisture loving species like *Prunella vulgaris*, *Veronica serpyllifolia*, *Geranium nepalense*, and *Trifolium repens*, are usually common along such plantations though the dominant species include *Poa annua*, *Plantago major*, and *Cynodon dactylon*.

Paddy fields dominate the general landscape in the valley. Thir borders support the usual perennial species like *Prunella vulgaris*, *Senecio chrysanthemoides*, *Plantago lanceolata*, *P. major*, *Taraxacum officinale*, *Sorghum halepense*, *Potentilla reptans*, *Cynodon dactylon* etc. The fields proper, especially near the borders, support several distinctive species especially in summer. The paddy fields remain dry from late autumn to spring and during this periods annual weeds including *Cardamine hirsuta*, *Stellaria media*, *Senecio vulgaris*, *Capsella bursa-pastoris*, *Poa annua* and *Veronica persica*, are locally common; but in most part of the summer and early autumn the fields have swampy habitat supporting several distinctive species like *Ammania auriculata*, *Rotala densiflora*, *Lindernia pyxidaria*, *Eriocaulon sieboldianum*, *Marsilea quadrifolia*, and species of *Cyperus*; in addition to *Echinochloa crusgalli* and *E. colonum*, the usual weeds of paddy fields.

The flood plain covered with scattered stones and boulders carried down the hill stream have desert conditions with isolated individuals of *Astragalus grahamianus*, *Berberis lycium*, *Stipa sibirica*, *Cynodon dactylon*, and *Bothriochloa pertusa*. Annual weeds like *Capsella bursa-pastoris*, *Setaria viridis*, *Arenaria serpyllifolia*, and *Poa annua* are often distributed on flood plain, though scarcely.

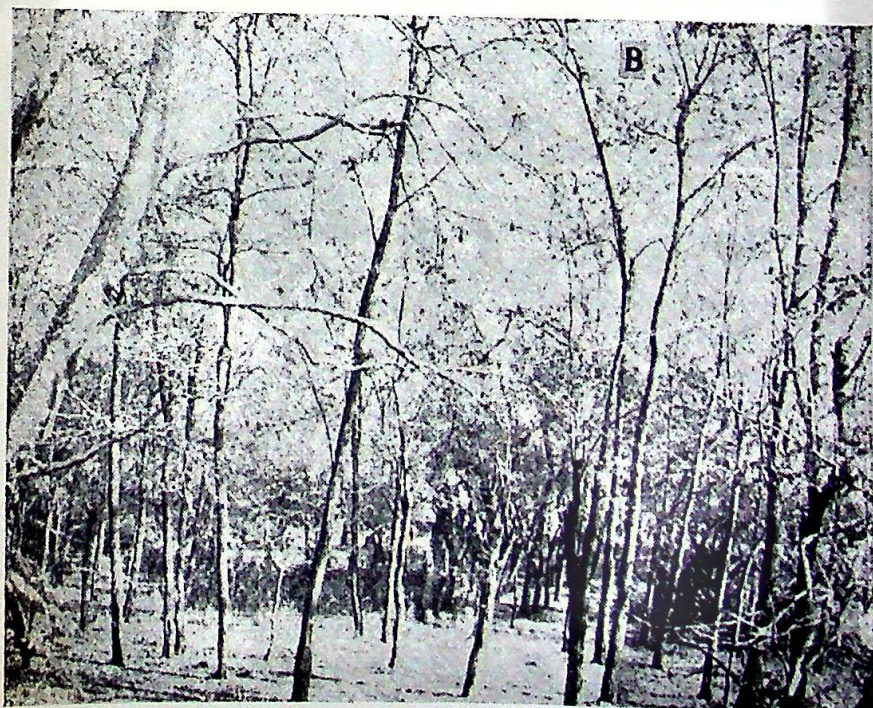
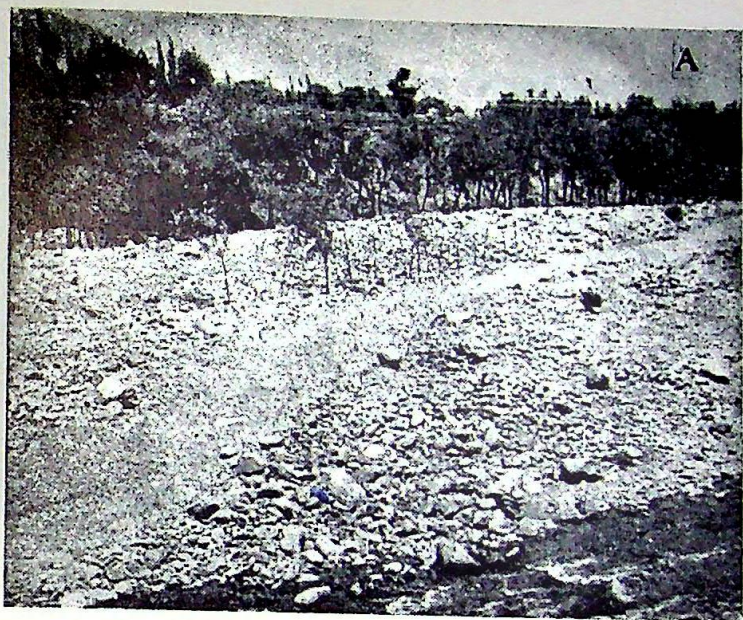
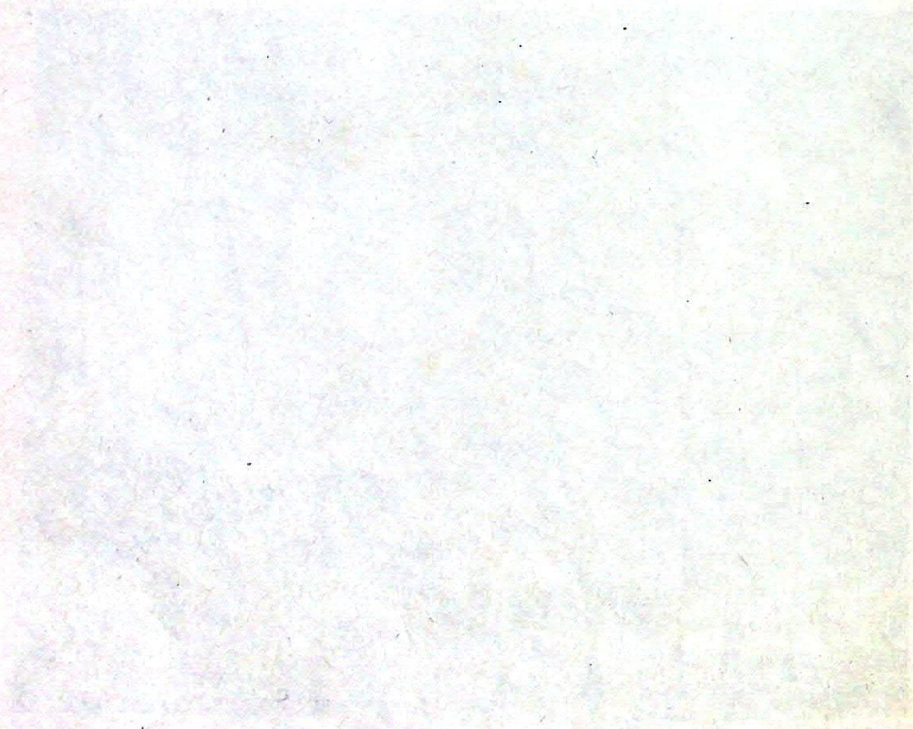
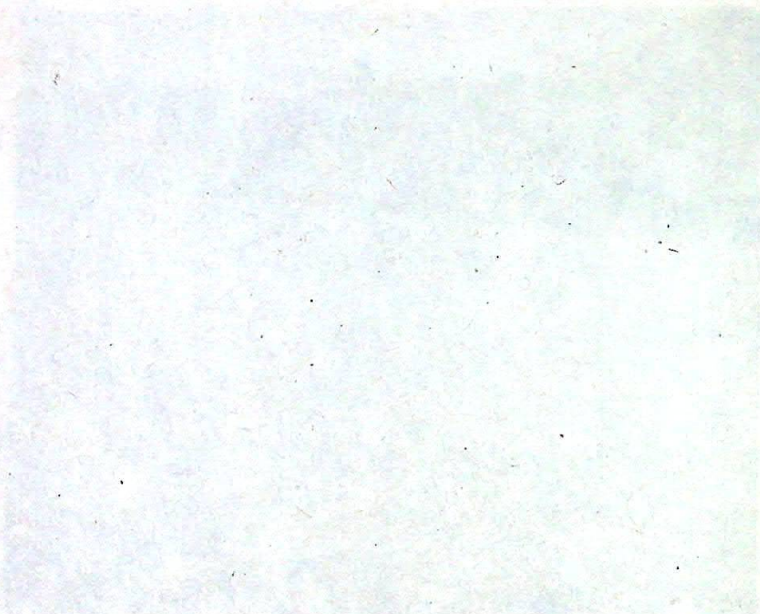


Plate 6. A. A flood plain outside Dachhigam sanctuary. Plantations of *Salix alba* on stream side.

B. A community of *Robinia pseudoacacia* in Dachhigam sanctuary. Note poor stratification. On left a portion of *Platanus orientalis*.



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The wastelands in the valley are generally dominated by matted savanas, though excessively grazed and trampled areas tend to be desert herbs. *Cynodon dactylon* and *Bothriochloa pertusa*, as in the matted savanas of mountain slopes, dominate such communities, and large proportion of annual is maintained in less trampled wastelands by occasional scraping and disturbance of ground. A great majority of weeds, however, are distributed in fields used for dry farming, and in orchards.

The graveyards support distinctive plantations of *Iris kashmiriana* and *I. nepalensis*. These are also subjected to grazing and have the usual components of matted savanas, though annual herbs are more common towards the spring. *Iris aurea* and *I. spurea* are also locally common on certain graveyards. Though generally present on graveyards, the *Iris* also forms communities of various sizes in protected wastelands.

In addition, swampy conditions are often developed under frequently inundated *Salix* plantation and have floor covered by seasonal communities of *Phalaris arundinacea*, *Rumex patientia* Ssp. *orientalis* with association of swampy species like *Impatiens glandulifera* *Myosotis caespitosa*, *Prunella vulgaris*, *Geum urbanum*, *Polygonum nepalense*, and *Geranium nepalense*. In the smaller ponds distributed in open situations grow *Alisma plantago*, *Rumex patientia* Ssp. *orientalis*, *Sagittaria sagittifolia*, *Sium latijugum*, *Polygonum hydropiper*, etc., while more deeper waters have communities dominated by *Typha angustata*, and *Phragmites communis*, in larger ponds.

LIFE FORMS

To classify the plants into suitable physiognomic types in terms of life forms irrespective of their phylogenetic position, Raunkiaer's (1909-1934) conventional classification with modification to suit standing conditions, affords a good skeleton to work with (see also Cain, 1950, & Braun Blanquet 1932). Further, since climatic differences between upper most subclasses of phanerophytes are least (Braun-Blanquet, 1932) their combination seems justified. Characterisation of subclasses in relation to height classes adopted in present study appears more expressive.

As there are hardly any herbaceous and succulent, phanerophytes, phanerophytic these species categories are not established in the area; but the characterisation of liana is well represented and they are recognised Chamaephytes which include a variety of plants deserve subdivision based on habit as do Hemicryptophytes; but due to considerable habit and perennating differences between terrestrial and aquatic plants, they are separated distinct as classes. Therophytes are held as a subdivision based on habit.

Conspectus of life forms

1. Phanerophytes-Ph (renewal buds above 25 cm)
 - A. Nanophanerophytes-N (usually scrubs 25 cm-2 m tall)
 - a. Evergreen nanophanerophytes-EN : *Juniperus communis*, *J. recurva*, *Rhododendron anthopogon*, *Daphne oleoides*, etc.
 - b. Deciduous nanophanerophytes-DN : *Isodon plectranthoides*, *Berberis pseudumbellata*, *Spiraea canescens*, *Prunus prostrata*, etc.
 - B. Microphanerophytes-Mi (trees and scrub 2-8 m tall)
 - a. Evergreen microphanerophytes-EMi : *Rhododendron campulatum*, *Cotoneaster aitchinsoni*, etc.
 - b. Deciduous microphanerophytes-DMi : *Parrotiopsis jacquemontiana*, *Staphylea emodi*, *Viburnum cotinifolium*, *Sorbaria tomentosa*, etc.
 - C. Macrophanerophytes-MM (trees taller than 8 m)
 - a. Evergreen macrophanerophytes-EMM : *Pinus griffithii*, *Abies pindrow*, *Picea smithiana*, etc.
 - b. Deciduous macrophanerophytes-DMM : *Ulmus villosa*, *Morus alba*, *Populus nigra* var. *italica*, *Platanus orientalis*, etc.
 - D. Phanerophyta scandentia-SPh (woody lianas) : *Hedera nepalensis*, *Rosa brunonii*, *Rubus niveus*, *Clematis grata*, etc.
2. Chamaephytes-Ch (renewal buds upto cm above ground)
 - A. Bryochamaephyta-BCh (carpet mosses) : *Mnium rostratum*, *Grimmia pulvinata*, *G. ovalis*, *Hedwigia ciliata*, etc.
 - B. Pteridochamaephyta-PCh (Pteridophytes) : *Selaginella jacquemontii*.
 - C. Chamaephyta reptantia-RCh (creeping herbs) : *Thymus serpyllum*, *Trifolium repens*, *Herniaria incana*, etc.
 - D. Chamaephyta suffrutescentia SfCh (semiscrubs) : *Lespedeza elegans*, *L. gerardiana*, etc.

- E. Chamaephyta valentia-VCh (creeping scrubs) : *Gaultheria trichophylla*, *Lespedeza juncea*, etc.
 - F. Chamaephyta succulenta-ScCh (succulents) : *Sedum ewersii*, *S. adenotrichum*, *Sempervivum sedoides*, *Bergenia ciliata*, etc.
3. Hemicryptophytes-H (buds at ground level, including biennials)
- A. Hemicryptophyta rosulata-RH (rosette plants) : *Plantago lanceolata*, *Taraxacum officinale*, *Bellis perennis* etc.
 - B. Hemicryptophyta scaposa-ScH (scapose plants. stem leaves presents) *Cichorium intybus*, *Verbascum thapsus*, *Centaurea iberica*, etc.
 - C. Hemicryptophyta scadentia-SdH (climbing and creeping herbs) *Convolvulus arvensis*, *Lathyrus pratensis*, etc.
4. Geophytes-G (perennating buds below ground) : *Allium atropurpureum*, *Ferula jaeschkeana*, *Colchicum luteum*, *Fritillaria imperialis*, etc.
5. Hydrophytes-Hy (water plants)
- A. Hydrophyta natantia-NHy (free floating) : *Lemna minor*, *Utricularia aurea*, *Salvinia natans*, etc.
 - B. Hydrophyta radicantia - RHy (rooted) : *Potamogeton crispus*, *Ranunculus trichophyllus*, etc.
6. Helophytes-He (Marshy and swampy plants with roots in soil below water and stems partially aerial) : *Typha angustata*, *Alisma plantago-aquatica*, *Sagittaria sagittifolia*, etc.
7. Therophytes-Th (annuals)
- A. creeping therophytes-CTh : *Trifolium dubium*, *Medicago minima* *Veronica didyma*. *V. persica*, etc.
 - B. Climbing therophytes-CITH : *Vicia hirsuta*, *Lathyrus aphaca*, *Polygonum dumentorum*, etc.
 - C. Erect therophytes-ETH : *Phleum paniculatum*, *Bromus japonicus*, *Vulpia myuros*, etc.

Biological spectrum of the flora

Life form spectrum for Dachhigam reserve and the adjacent areas ranging between 1,680 and 4,000 m, based on 681 species including mosses and the higher plants on comparison, with the Raunkiaer's normal spectrum revealed the general

scarcity of phanerophytes, though other life form classes were well represented. The paucity of phanerophytes, being less than one third of normal spectrum, is well appreciated from the comparison with life form spectrum of subtropical evergreen vegetation of Madras (Bharucha and Ferriera, 1941), having 60 per cent phanerophytes as against only 14 per cent in our areas. Dachhigam reserve with adjacent areas shows marked increase in therophytes and cryptophytes here taken to include geophytes, hydrophytes and helophytes) including 25 and 28 per cent species as against 13 and 6 in normal spectrum respectively in the Madras spectrum. The marked increase in cryptophytes is ensured through the predominantly temperate climate with Mediterranean influence, the Kashmir valley forming the eastmost limit of Mediterranean climate. The hemicryptophytes and chamaephytes show the normal distribution in the area as a whole.

The detailed consideration of the spectrum Table revealed evergreen phanerophytes to be poorly represented, the area

Table 52. Detailed life form spectrum for Dachhigam reserve and adjacent areas.

Life forms classes		Percentages
Ph		14.5
	EN	0.3
	DN	3.1
	EMi	0.6
	DMi	4.1
	EMM	0.6
	DMM	4.1
	SPh	1.7
Ch		8.8
	BCh	13.5
	PCh	0.1
	RCh	12.1
	SfCh	1.9
	VCh	0.4
	ScCh	0.8
H		23.1
	RH	1.6
	ScH	17.4

Life form classes	Percentage
SdH	4.1
G	22.7
Hy	1.4
NHY	0.8
RHY	0.6
He	4.2
Th	25.1
CTh	6.4
Clth	0.8
ETh	17.9

being dominated by broad leaved deciduous phanerophytes. All the height classes of deciduous phanerophytes are well represented. The chamaephytes are principally represented by mosses and creeping herbs, the bulk of hemicryptophytes are represented by the erect scapose forms. The area being largely mountainous the cryptophytes are almost exclusively represented by the geophytes, both hydrophytes and halophytes being insignificant. Therophytes are also dominated by erect forms, though creeping forms were also well represented.

Biotic influences : Though general scarcity of phanerophytes and prevalence of geophytes agree with the type of climate prevalent in the area, as is true for Kashmir valley as a whole, the striking increase in the therophytes : the dominant components of desert vegetation, presents departure. The consideration of life form spectrum of the protected slopes which support more natural vegetation, on comparison with the areas outside the sanctuary (Table) revealed that this general increase in the therophytes is related to the biotic influences, the results being quite appreciable when the spectra based on frequency counts were considered. The protected slopes of reserve have poor representation of therophytes as compared to the mountain slopes outside the sanctuary in the same altitudinal zone. Similar decrease was found from Harwan-New Thir valley to Dachhigam ravine. The portions of the ravine have more representation of therophytes as compared to the mountain slopes of reserve. The fact that these thero-

Table. Comparison of life form spectra of Dachhigam reserve with the areas outside the sanctuary.

Region	Life from classes						
	Ph	Ch	H	G	Hy	He	Th
Harwan-New Thir valley	(Species 267)						
a. Species counts	14.6	2.6	17.2	2.2	2.6	15.4	45.3
b. Frequency counts	15.3	4.2	27.2	1.5	2.3	11.4	37.9
Harwan mountain slopes	(1,800-2,400 m, species 235)						
a. Species counts	14.9	7.2	24.3	26.4	—	—	27.2
b. Frequency counts	12.9	5.4	32.0	20.6	—	—	29.2
Dachhigam ravine (Species 233)							
a. Species counts	22.6	4.2	24.0	17.3	1.0	4.2	26.8
b. Frequency counts	37.9	3.5	22.4	12.4	0.1	1.8	21.8
Dachhigam mountain slopes (1,800-2,400 m, species 216)							
a. Species counts	23.1	6.0	24.5	28.2	—	—	18.0
b. Frequency counts	26.9	4.5	27.7	29.1	—	—	11.7

phytes are commoner along roadsides and on disturbed ground, and mostly in cultivated fields, suggests the role of biotic dispersal and reduced competition in the prevalence of therophytes. Geophytes showed marked decrease in greatly influenced valley outside the sanctuary, the phanerophytes being reduced through excessive lopping and geophytes through excessive grazing and trampling making the surface compacter enough to allow the survival of geophytes.

Altitudinal variation : To understand the sequences of various life forms with altitudinal increase, aspects calculated at different altitudinal zones separated by 300 m were compared (Table 54). The phanerophytes being better represented in the forest zone showed a sharp decline above silver fir zone, finally disappearing above 3,700 m. Chamaephytes on the other hand, showed a sharp increase above silver fir zone. Both phanerophytes and chamaephytes showed essentially uniform distribution up to 2,900 m, the upper limit of silver fir zone. Hemicryptophytes which showed an initial increase while passing into slopes from the valley below, being uniformly distributed up to 2,300 m, also exhibited a sharp increase above that. The geo-

Table 54. Comparison of life form spectra at various altitudinal zones in Dachhigam reserve and adjacent areas.

Altitude (m)	No. of species	Life form classes						
		Ph	Ch	H	G	Hy	He	Th
1,700	439	16.6	3.9	19.6	17.5	2.3	6.6	33.5
2,000	310	18.1	6.5	27.1	25.1	—	1.9	21.3
2,300	230	19.4	7.4	26.1	30.9	—	0.5	15.6
2,600	130	13.8	6.9	25.4	40.0	—	0.8	13.1
2,900	80	16.2	5.0	32.7	34.2	—	—	11.7
3,200	76	9.2	10.5	39.1	30.3	—	—	10.8
3,500	54	7.4	14.8	44.4	22.2	—	—	11.1
3,800	35	—	22.9	45.7	20.0	—	—	11.4

phytes showed an increase with altitudinal increase, reaching their maximum at near 2,600 m. Above this they showed a decline towards higher altitudes. The therophytes, of all, showed decrease with altitudinal increase up to the upper limit of silver fir zone, showing essentially uniform distribution above that.

SUCCESSION

A number of successional trends visible in the area and determined by exposure and altitude are secondarily modified by several factors including lopping, grazing, fires, erosion, and management. The northerly and southerly aspects differ considerably in the microclimatic factors and species composition; consequently, the successional trends are different. These are also related to altitudinal differences, resulting in different climax types.

Primary succession

Northern aspects: The pioneer lichens on northerly aspects are followed by mesophytic lichens *Peltigera polydactyla*, *P. canina*, *Diploscistes scruposus* associated with mosses like *Grimmia evalis*, *Orthotrichum cupulatum*, *Tortula ruralis*, *T. inermis*, *Cryptoleptodon flexuosus*, forming large cushions on rocks. These species are subsequently followed by large patches of moss species *Leucodon aciuroides*, *Hedwigia ciliata*,

Hypnum cupressiforme, associated with mesophytic lichens *Cladonia fimbriatus*, *Dermatocarpon* sp., etc.

Selaginella jacquemontii apparently plays an important successional role on northerly slopes. Large patches of this species, which follows the mosses, play an important role in soil building and retention, and are succeeded by perennial species like *Bergenia ciliata*, *Valeriana stracheyi*, *Sedum ewersii*, etc., mostly the succulent species, which through massive root-stocks to survive the growing conditions have efficient role in soil building and retention, mostly restricted to rock crevices and gradually spreads over the general slope. The herbaceous species to follow include *Asperula cynanchica*, *Erysimum hieracifolium*, *Carex setigera* var. *sehlagintweitiana*, *Poa stewartiana*, *Fragaria vesca*, etc. Several pernnial species including *Eremurus himalaicus*, *Allium consaguineum*, *Polygonatum verticellatum*, *Valeriana hardwickii*, have localised role on certain slopes.

The first scrubs to colonize the slopes include *Spiraea canescens*, *Indigofera heterantha*, *Ribes glaciale*, *Jasminum officinale*, to be later followed by mesophytic species *Viburnum cotinifolium*, *Parrotiopsis jacquemontiana*, etc. Through their growth these species make soil conditions favourable for tree species *Pinus griffithii*. *Euonymus fimbriatus*, *Staphylea emodi*, but *Pinus griffithii* with better adaptations to survive through unfavourable periods, overgrows these deciduous trees species to form climax communities at lower levels.

In the silver fir zones, though blue pine is the first conifer to colonize, yet more hardy silver fir invades from adjacent slopes to colonize and blue pine is replaced by silver fir in the course of time. In such blue pine communities, the deciduous tree species including *Ulmus wallichiana* Ssp. *xanthoderma* *Corylus colurna*, and *Padus cornuta* have an important successional role, often colonizing before or along with the blue pine, to be replaced by this species.

Southern aspects : The drier unfavourable growing conditions on southerly aspects have very slow successional rate,

suggesting why certain ranges with climax forest developed on northerly aspects have scrub savana on southern aspects of Kashmir valley as a whole. Following crustose lichens, the thallose lichens are associated and followed by mosses like *Grimmia pulvinata*, *G. ovalis*, *Orthotrichum affine*, and *O. anomalum*. It is not until good soil conditions have been developed by these species, especially along rock crevices, that *Inula obtusifolia*, *Nepeta salvaefolia*, *Pennisetum orientale*, *Thymus serpyllum*, etc., come to develop on these slopes with isolated individuals of *Ajuga remota*, *Herniaria incana*, *Arabidopsis wallichii*, etc. Tufted grasses *Themeda anathera* and *Chrysopogon echinulatus* are the subsequent invaders forming dominant communities on most southerly aspects; and associated with other herbs, the usual being *Saussurea albescent*, *Galium verum*, *Serratula pallida*, *Onosoma hispidum*, *Origanum normale*, and *Artemisia vestita*. The first scrubs to invade these slopes include the microphyll scrubs *Cotoneaster racemiflora*, *Indigofera heterantha*, *Prunus prostrata*, together with the thorn scrubs *Rosa webbiana*, and *Berberis lycium*. Growing conditions are still remote for tree species, but adjacent blue pine community on northerly aspect manages to extend along the borders, which are concentrated with these scrubs, to replace them and blue pine colonizes these slopes in the course of time.

Secondary succession

Three important trends of secondary succession are visible in the area controlled by (a) lopping and grazing, (b) protection, (c) progressive cultivation and plantations.

Lopping and grazing: The diverse types communities developing on mountain ranges outside the sanctuary are the secondary developments influenced by lopping and grazing effects, continued lopping of trees has led into the development of *Parrotiopsis* and *Isodon* scrubs on most slopes, but followed by continued lopping and grazing, since former species forms good fuel wood and palatable foliage for cattle. It soon disappears and hardy species like *Indigofera heterantha*, *Rosa webbiana*, and *Berberis lycium* increase. Though *Isodon* survives considerable grazing, under further grazing effects the

thinning of its stands followed by increased association of poisonous herbs *Stipa sibirica*, *Aremisia vestita*, *A. nilagirica*, and *Origanum normale* occurs. Considerable disturbance of the floor results in invasion of numerous annual species which are especially dominant in spring. Further grazing accompanied by trampling effects result in gradual disappearance of *Isodon* and other scrubs, and increase of poisonous herbs. The continued process of grazing and trampling results in decrease in these taller poisonous herbs, and association of matted herbs *Cynodon dactylon* and *Bothriochloa pertusa*. Though taller poisonous herbs survive grazing effects, under accompanied continuous trampling these species slowly disappear with increase in both these matted grasses. Increased trampling making the soil compact also results in gradual disappearance of annuals and under the effect of excessive grazing the matted savanas dominated by *Cynodon dactylon* and *Bothriochloa pertusa* result, with the association of only a few low growing perennial herbs. Under extreme grazing effects, and accompanied erosion, these matted grasses also thin out resulting in the development of desert herb conditions.

On more southerly aspects the grazing results in quick disappearance of *Chrysopogon echinulatus* and *Themeda anathera* followed by increase of thorn scrubs *Rosa webbiana*, *Berberis lycium* and microphyll scrub *Isodon plectranthoides*. Though some taller herbs increase in prominence, supported by *Thymus serpyllum*, *Herniaria incana*, the desert conditions are soon established. The matted herbs *Cynodon dactylon* and *Bothriochloa pertusa* invade slowly but excessive grazing maintain desert conditions on most steeper slopes, though gradual slopes are covered by these pasture species.

Protection : The successional trend initiated through the protection of the area from grazing and lopping effects is visible on outer ranges of the sanctuary. There is reversion of the pattern controlled by grazing and the areas under matted pastures are developed into *Isodon* scrub, to be replaced by *Parrotiopsis* in the course of time. The gregarious habit of *Parrotiopsis* often affords similar microenvironment as that

in the deciduous forests and forms conditions favourable for blue pine to invade and colonize the slopes.

Similar reversion of grazing effects is exhibited on southerly aspects. The initial stages of secondary succession on gradual slopes at lower altitudes have association of several deciduous tree species including *Prunus cerasifera*, *P. armeniaca*, *Rhus succedenea*, *Morus alba*, especially in the areas closer to the ravine, before blue pine colonizes, similar trends being also found on the lower level northerly aspects. The gradual slopes of outflanked gulleys and the ravine in addition to thorn scrubs *Rosa brunonii*, *R. webbiana*, and *Berberis lycium*, and microphyll scrubs have frequent association of deciduous tree species, and the trend of secondary succession suggests the role of deciduous tree species in successional pattern in the ravine, having more mesophytic conditions than elsewhere on slopes, ensured through the mainstream and lower altitude.

Plantations and cultivation : Most of the lower slopes outside the sanctuary are being slowly enclosed for cultivation. These enclosed areas which are left as such for some years show partial reversion of grazing effects. The annuals grow out and the taller species increase. These are, however, soon ploughed and developed into fields which have marked increase of weeds in the course of time, or into orchards which under the tree shade ensure the trend towards increase in shade loving species like *Oxalis corniculata*, *Potentilla reptans*, *Prunella vulgaris*, *Taraxacum officinale*, *Stellaria media*, etc. Although *Cynodon dactylon* and *Bothriochloa pertusa* are still dominant, yet the annuals also increase.

The plantations of *Salix alba* and *Robinia pseudoacacia* also influence the successional pattern. The *Robinia pseudoacacia* plantation results in the disappearance of both the grasses and scrubs so that the floor is quite sparsely covered with. Certain shade loving species like *Viola odorata*, *Potentilla reptans*, *Siegesbeckia orientalis*, etc. increase.

The *Salix* plantations in swampy places have the gradual increase of *Phalaris arundinacea*, *Myosotis caespitosa*, *Prunella*

vulgaris, *Polygonum nepalense*, *Rumex patientia* Ssp. *orientalis* in frequently inundated areas, while under the natural conditions, there is slow disappearance of marshy species and increase in shade loving terrestrial ones.

STATISTICAL APPRAISAL OF FLORA

A total of 661 species belonging to 376 genera distributed under 111 families are recorded (Table 4). A purview of the statistical synopsis of the local flora shows that considering the the percentage of Dicots and Monocots in the world (81.7 and 18.3 % respectively), 19.1 % of Monocotyledons in Dachhigam (considering Angiosperms only) compares well with Simla 23.3 %; Collett, 1921). This is significant with reference to the fact that there are only 12.5 % Monocots in the Indian flora, and that Orchidaceae (Monocots) which is the largest family of Indian flowering plants is so poorly represented in our area. The high percentage of Monocots at Dachhigam is consequently attributed to the presence of large number of grasses and sedges. Of the 122 species of Monocots in the areas 53 are grasses alone.

Table 4. Statistical synopsis of the flora of Dachigam sanctuary

	Dicotyledons	Monocotyledons	Gymnosperms	Pteridophytes
Families	85	17	2	7
Genera	289	70	5	12
Species	518	122	6	15

Of the 111 families the frequency of the 10 major ones with respect to some neighbouring areas in northern India is given in Table 5.

Comparing the elements of our largest families (Table 6) with the neighbouring areas in the Orient and in far Malaya, it is noted that Cruciferae, Caryophyllaceae, Umbelliferae and Boraginaceae are little represented in Malaya, and taking the flora of the country as a whole (Table 5, col. 6) Gramineae alone features as a major element. Taking the country as a whole with dominant tropical influence, Compositae falls low in

Table 5. Dominant families in order of frequency in Dachigam and neighbouring areas in northern India.

Dachigam	Srinagar valley	Simla	Jammu	Delhi	India
Compositae	Compositae	Gramineae	Leguminosae	Gramineae	Orchidaceae
Gramineae	Gramineae	Leguminosae	Gramineae	Liguminosae	Leguminosae
Rosaceae	Cruciferae	Compositae	Compositae	Compositae	Gramineae
Labiatae	Leguminosae	Labiatae	Cyperaceae	Cyperaceae	Rubiaceae
Leguminosae	Labiatae	Cyperaceae	Scrophulariaceae	Acanthaceae	Euphorbiaceae
Cruciferae	Cyperaceae	Rosaceae	Labiatae	Euphorbiaceae	Acanthaceae
Umbelliferae	Umbelliferae	Scrophulariaceae	Euphorbiaceae	Convolvulaceae	Compositae
Boraginaceae	Rosaceae	Orchidaceae	Acanthaceae	Malvaceae	Cyperaceae
Caryophyllaceae	Ranunculaceae	Urticaceae	Amaranthaceae	Amaranthaceae	Labiatae
Cyperaceae	Scrophulariaceae	Liliaceae	Cruciferae	Scrophulariaceae	Urticaceae

Table 6. Distribution of dominant families of Dachigam in neighbouring geographical regions in the old world. Genera (Species).

Family	Dachigam	Kashmir	Afghanistan	Lowland Iraq	European Turkey	Malaya	Balkan
Cruciferae	18 (28)	52 (141)	75 (189)	49 (91)	45 (93)	1 (1)	90 (353)
Caryophyllaceae	13 (20)	19 (83)	18 (93)	22 (52)	27 (96)	2 (3)	39 (395)
Leguminosae	16 (33)	42 (163)	42 (353)	24 (115)	35 (206)	67 (271)	79 (525)
Umbelliferae	18 (26)	44 (87)	33 (65)	32 (51)	43 (82)	4 (6)	89 (323)
Compositae	44 (75)	94 (396)	85 (436)	70 (163)	61 (226)	30 (40)	159 (916)
Boraginaceae	14 (19)	25 (62)	27 (65)	18 (39)	15 (63)	6 (12)	29 (143)
Scrophulariaceae	7 (18)	26 (95)	18 (79)	9 (23)	16 (66)	15 (47)	29 (299)
Labiatae	17 (33)	33 (127)	32 (161)	13 (28)	27 (109)	18 (31)	40 (356)
Cyperaceae	8 (21)	9 (148)	8 (64)	6 (29)	11 (43)	24 (145)	N.A.
Gramineae	36 (58)	100 (250)	78 (167)	69 (153)	71 (168)	83 (204)	92 (406)
Rosaceae	19 (40)	29 (136)		3 (3)	8 (37)		

the table of larger families but tops the flora of the region as also Kashmir valley both of which are predominantly under the influence of temperate climate. Labiatae is another temperate family, and consequently stands higher in the list. Majority of our species and genera are common with the Orient and the Mediterranean areas.

Comparing flora of the region with Burmese flora it is found that similarity is met in the subalpine genera, primarily *Thalictrum*, *Rhododendron*, *Primula*, *Saxifraga*, *Androsace*, etc. Kingdom Ward (1921) ascribed this to presence of temperate climate in southern and eastern Tibet. The Himalayan uplift in Eocene times converted Tibet into a desert and the flora migrated to Burma.

The distribution of the diverse elements in the 30 families of the region represented by a single genus each make an interesting reading (Table 7). Of these families Violaceae, Hamamelidaceae, Verbenaceae, Illecebraceae and Celastraceae include large number of genera but none is so well represented even in India as a whole. Of these various genera, excepting *Parrotiopsis*, *Platanus*, all are well represented in the country. At the specific level most of our species are found in the Himalayas alone in the country, but few of the species are found in the north and south e.g. *Viola serpens*, *Callitriche stagnalis*, *Utricularia aurea* etc. A few are restricted to only Kashmir in India. Most other species range from Kashmir to Kumaon, and few have cosmopolitan distribution.

Only eleven genera have six or more species. *Polygonum* (ca 150 species in all latitudes, 80 in India, 38 in Kashmir) is represented by 12 species, none of which has restricted distribution. *Veronica* (ca 380 species chiefly tropical mostly America, 58 in India, 24 in Kashmir) has 9 species, majority of these having wide distribution. *Galium* (ca 150 species chiefly temperate, 22 in India, 16 in Kashmir) is represented by 8 species, mostly distributed in temperate Himalayas, a few European species represented only in Kashmir in India. *Ranunculus* (ca 160 species, temperate cold regions, 42 in India, 32 in Kashmir) has 7 species which range elsewhere in India mostly

Himalayan. *Geranium* (ca 266 species, cold temperate northern hemisphere, 30 in India, 19 in Kashmir) is represented by 8 species, mostly in temperate Himalayas. *Prunus* (80 species, northern temperate regions rarely in tropics, 22 in India, 12 in Kashmir) is restricted to Himalayas in India and none of our 7 species is restricted. The 7 species of *Nepeta* (120 species, temperate Europe, Asia, N. Africa, 52 in India, 36 in Kashmir) in our area show interesting range, some being very widely distributed, some others restricted to Himalayas. The 7 species of *Impatiens* (150 species, in temperate northern Hemisphere, 130 in India, 16 in Kashmir) in Dachhigam are widely distributed in the Himalayas. Of the 6 species of *Poa* (80 species, temperate and cold regions, in India, 26 in Kashmir) only *P. stewartiana* is restricted, the rest well represented in Himalayas, a few of wide distribution in northern Hemisphere. *Carex* (1100 species, throughout the world, 160 in India, 62 in Kashmir) is represented by six species in our area, mostly widely distributed in world. Of 85 species of *Cyperus* in India (300 species, warm regions and temperate, 26 in Kashmir) only six occur in our area, but all are widely distributed swamp weeds, *Iris* (100 species, northern temperate regions, 16 in India) a Himalayan element in India is represented by six species in the area of these *I. Kashmiriana*, *I. aurea* and *I. hookeriana* being restricted to Kashmir and bordering areas (11 species in Kashmir, *I. kumaonensis* is also reported but does not grow west of Lahul; *I. clarkie* reported by Rao from Kashmir is *I. spuria* L., *I. clarkie* being E. Himalayan species).

NEW RECORDS

NEW RECORDS FOR INDIA

***Galium parisiense* L. Ssp. *anglicum* (Huds.) Clapham; Clapham et al., Fl. Brit. Isles 785, 1962.¹**

G. anglicum Huds., Fl. Angl. ed. 2, 69, 1778.

G. parisiense Butcher, New Ill. Brit. Fl. 2, 408, 1961 (non L.).

Annual herb, divaricately branched above, erect, minutely retrorsely scabrid to subglabrous, 15-30 cm tall, slender. Leaves usually in whorls of 5-7, linear, cuspidate, anterorsely scabrid

on the margins, single nerved, 7-14 mm long. Flowers on slender divaricate peduncles; cymes many flowered, much longer than the subtending bracts; pedicels filiform, 2-4 mm long, in flowering, elongating to often 8 mm and slightly curved in fruiting, 0.07-0.09 mm thick. Calyx obsolete. Corolla greenish white within, reddish outside, 0.4-0.6 mm across, lobes narrowly ovate. Mericarps granulate, glabrous, 0.8-0.9 mm long, ovoid, finally black.

Habitat : Open dry slopes, Harwan.

Flowers : May-June.

G. parisiense Ssp. *anglicum* is close to *G. tenuissimum* M. bieb., which also grows in our area, but can be separated as under :

<i>G. parisiense</i> Ssp. <i>anglicum</i>	<i>G. tenuissimum</i>
Plants usually erect, 15-30 cm tall.	Plants ascending, upto 60 cm tall.
Leaves 7-14 mm long.	Leaves 8-20 mm long.
Corolla 0.4-0.6 mm across, greenish white within, reddish outside.	Corolla 0.8-1.0 mm across, white or yellowish white.
Pedicels less than 0.1 mm thick, often elongating to 8 mm in fruiting.	Pedicels more than 0.1 mm thick, scarcely more than 5 mm long in fruiting.
Mericarps 0.8-0.9 mm long, ovoid.	Mericarps 1.3-1.5 mm long, reniform.

In its distribution the species occurs in Central and South Europe, North Africa and West Asia. It is commoner on drier slopes in and around Srinagar.

Galium gilanicum Stapf, in Denkschr. Acad. Wein 1:53, 1885; Rechinger, Fl. Lowland Iraq 367, 1964.

G. parisiense L., var. *brachypodum* Boiss., Fl. Orient. 3:72, 1875.

Annual herb; stems numerous ascending from the base, 6-15 cm long, minutely retrorsely scabrid. Leaves in whorls of 6-8, linear-lanceolate, acuminate, 6-11 mm long, single nerved, anterorsely scabrid on the margins and midrib beneath. Cymes axillary on 11-18 mm long peduncles, 2-4 flowered. Pedicels

1.5-3 mm long, slightly elongated in fruit, 0.12-0.15 mm thick, slightly recurved in fruiting. Flowers yellowish white, 0.8-1 mm across. Corolla lobes ovate, acute. Mericarps 1.2-1.5 mm long, reniform, granulate, glabrous, finally black.

Habitat: Usually below scrubs on dry open slopes, Harwan.
Flowers: April-May.

With Persia as its original home, the species is distributed in Iraq, Afghanistan, etc. It is commonly distributed in cultivated areas, orchards, and below scrubs on dry slopes in and around Srinagar.

Hypocoum pendulum L, Sp. Pl. 124, 1753; Fedde in Engler, Das Pflanzenreich Heft 40:95, 1909.

Annual herb, procumbent to ascending. Leaves many forming a basal rosette, glaucous, 2-to 3-pinnatisect, unequally divided into linear segments; cauline few, subopposite, palmatisect. Pedicels 1.5-3 cm long, elongating in fruit. Sepals 2 ovate, subobtus, \pm 2 mm long. Petals 4, pale yellow, in two, whorls; outer entire, oblong, 6-9 mm long. \pm 3 mm broad; inner deeply trifid, 4-7 mm long, midlobe stipitate suborbicular and ciliate; petals black dotted. Stamens 4; filaments flattened, 4-5 mm long, black dotted; anthers linear, 2-3 mm long, yellow. Fruit pendulus, a lomentum, 3.5-5 cm long, not jointed, epidermis not exfoliating; stigmas two.

Pampore saffron fields, Kashmir: Gurcharan Singh No. 657;
Sombra saffron fields, Kashmir.
Flowers: April-May.

This species is quite distinct from *H. leptocarpum* Hook. f. and T. (Which has purple flowers, erect hardly 1.5-2 cm long fruits disarticulating into one seeded joints), and *H. procumbens* L. (which has yellow flowers, outer petals tripartite, fruit erect and jointed). Though occurring in regions North West of India including Beluchistan (Duthie 8567. cited in Das Pflanzenreich), Kohat in Pakistan (Anderson 95a): Queta in Pakistan (Duthie 8568), Kurrum valley in Afghanistan (Aitchinson 183: err. det. *H. procumbens* L.), Chitral in Pakistan (Hamilton 1896), Kurrum

valley in Afghanistan (Harsukh 14787: err, det. *H. procumbens* L.), Peshawar in Pakistan (R.R. Stewart 47: err. det, *H. procumbens* L.), and regions of S. W. and S. E. Europe, but there seems to be no record of this species from within present boundaries of India.

Sagina apetala Ard., Animadv: Bot. Spec. 2: 22, 1763; Clapham and Jardine, Flora Europaea 1:147, 1964; Culen in Davis, Fl. Turkey 2:91, 1967.

Erect slender annual herb, 3-7 cm tall branches capillary. Leaves linear, 4-9 mm long, mucronate. Pedicels capillary, erect, almost glabrous, 6-11 mm long. Flowers 4-merous, ca 1.5 mm across. Sepals ovate, hooked at apex, spreading in fruit. Petals minute. Capsule equalling the sepals or slightly exserted. Seeds reniform, tuberculate.

Habitat: Pastured slopes, above Harwan.

Flowers: April.

The other two Indian species of the genus: *S. procumbens* L. and *S. saginoides* (L.) Karst. are distinct in being perennial herbs with ascending habit, thicker stems and distinct petals. *S. saginoides* is distinctly pentamerous.

S. apetala is of wide distribution ranging from Europe, northwards to Denmark and Sweden, North Africa, West Asia, and South America.

NEW RECORDS FOR KASHMIR VALLEY

Arenaria festucoides Benth. in Royle Ill. Bot. Himal, 81, t. 21, t. 3, 1839; Edgew. and Hook. f. Fl. Brit. India I : 236, 1872.

A densely tufted perennial herb ; leaves densely crowded, linear-subulate, shining, 1-3 cm long, rather concave above, strongly one-nerved beneath, ciliolate; peduncle usually 3-10 cm, glandular pubescent, few flowered; bracts linear-lanceolate with scarious margin; sepals lanceolate or subulate lanceolate, 4-10 mm long, margin scarious, nerves usually 3; petals usually twice

as long as sepals, obovate; capsule shorter than sepals, oblong; 5-6 valved to the base; seeds flat with a narrow wing; Apharwat; 13,000 ft. (Gurcharan Singh 84), fls, July-August.

The plant is easily distinguished by its shorter, tufted habit and larger petals. It also found growing at Kunawar (Royle 1839) Kumaon and W. Tibet (Edgew. & Hook. f. 1872) in the Himalayan range.

Crambe cordifolia Stev., var. **kotschyana** (Boiss) O.E. Schulz in Engl., Das Pflanzenreich Heft 70: 236, 1929.

C. cordifolia Hook. f. & Anders., Fl. Brit. India 1: 165, 1872 (non Stev.).

Perennial herb, upto 2 m tall, 1-2 m wide in flowering, obtuse angled, sparsely hairy. Radical leaves large, cordate or subreniform, upto 20 cm across, petiole 15-30 cm long; cauline leaves smaller, on shorter petioles, ovate or elliptic. Racemes lax, many flowered. Pedicels upto 2 cm long in flowering. Sepals 4-5 mm long, outer oblong, inner ovate. Petals 8-10 mm long, white, limb obovate. Stamens 4-6 mm long, inner two toothed near top; anthers 1-1.5 mm long. Silicula indehiscent, jointed, upper cell one seeded, globose, 5-7 mm across; lower cell forming the upper part of the pedicel, sterile. Seed ca 1.5 mm, slightly compressed, globose.

Habitat: Humus rich soils below rocky cliffs:

Flowers : April-May.

Identified with *C. cordifolia* Stev. in "Flora of British India" this species proper can be separated from the Ssp. **kotschyana** as under :

C. cordifolia

Pedicels less than 1 cm long in flowering
Sepals 2.5-3 mm long, petals 6-7 mm long, stamens ca 3 mm long, anthers ca 1 mm long.
Fruiting pedicels upto 1.5 cm long.
Lower sterile cell of the fruit ca 1 mm long, silicula ca 5 mm across.

C. cordifolia Ssp. *kotschyana*

Pedicels 1-2 cm long in flowering
Sepals 4-5 mm long, petals 8-11 mm long, stamens 4-6 mm long, anthers 1-1.5 mm long.
Fruiting Pedicels 2-4 cm long.
Lower sterile cell 2-3 mm long
silicula more than 5 mm across.

J. D. Hooker and T. Anderson (1872) in "Flora of British India" noted that "some tibetan specimens have broader petals and shorter stamens (with the filaments of long stamens almost simple) than found in Afghan and Caucasian; but these plants agree in all other respects" but they did not consider it to be distinct from *C. cordifolia* Stev., which is primarily distributed in the Caucasus.

C. cordifolia Ssp. *kotschyana* had earlier been collected from Kunawar, Western Tibet, Afghanistan, Beluchistan, Persia, etc., but not from Kashmir Valley.

Euphorbia prostrata Ait., Hort. Kew. 2: 139, 1789; Santapau, Journ. Bomb. Nat. Hist. Soc. 46: 380, 1946; Maheshwari, Fl. Delhi 313, 1963; Nair and Pant, Bull. Bot. Surv. India 8 (1): 75, 1966.

Prostrate annual herb; stems several from base, slender, purplish, sparsely hairy. Leaves opposite, serrulate towards tip, 4-8 mm long, oblong, upto 4 mm broad, base oblique. Involucres axillary, usually paired. Glands 4, green with a minute petaloid limb. Capsule small, green, ca 1 mm across, angles keeled, glabrous except for hairy keels. Seeds angled, brown, with transverse furrows.

Locality: Emporium Garden, Srinagar.

Flowers: September-November.

Glycine soja Sieb. and Zucc., in Abh. Acad. Muench. 4(2):119, 1845; Ohwi, Fl. Japan 570, 1965; Verdcourt, Kew Bull. 24:256, 1970.

G. ussuriensis Regel and Maack in Regel, Tent. Fl. Ussur. 50, 1861; Hermann, in U.S. Dep. Agr. Tech. Bull. No. 1268: 37, 1962.
G. soja Baker in Hook. f., Fl. Brit. India 2:184, 1876 (Pro parte).

Annual slender twinner, most of the branches 1.5-2 mm across, pubescent with short brownish hairs; petiole slender, 2-5 cm long, 1-1.2 mm broad, upper leaves successively smaller and shorter petioled; leaflets ovate-lanceolate or elliptic-lanceolate, 2.5-6 × 1.5-2.2 cm, base rounded or almost truncate, apex mucronate, terminal leaflet on 7-12 mm long petiolule; petiole,

petiolules and veins beneath covered with short brownish pubescence. Flowers in axillary clusters of 1-3. Bracts linear, 2-2.5 mm long. Pedicel 1.5-3 mm long. Calyx tube ca 1.5 mm long, lobes linear-filiform, 2-3 mm long; calyx and pedicel all over covered with brownish pubescence. Pod 20-30 × 4-6 mm, covered densely with 1-1.3 mm long brownish hairs, chocolate brown when ripe; seeds 3-4, oval black with small white hilum, 4-5 × 2.5-3 mm.

Habitat: Among scrubs in forest opening in ravine.
Flowers: June-July.

Baker (1876) regarded the cultivated specimens and the wild ones to be belonging the same species. The nomenclature of the genus *Glycine* has been to much discussion in the recent years and it is now largely agreed that the cultivated species *G. max* (L.) Merr. is quite distinct from the wild *G. soja* Sieb. and Zucc. P.W. Ball in *Flora Europaea* 2:128, 1968 writes "The origin of this species (the soya bean of commerce) is not known. It has probably been derived from *G. soja* Sieb. and Zucc. a native of Asia." The specimens having gone under the single name of *G. soja* in "Flora of British India" thus fall into two species, *G. max* being the cultivated species and *G. soja* being the wild species, and the two can be separated as under:

G. max

(cultivated)

An erect bushy annual.

Leaves thick, broader.

Flowers in axillary racemes of 5-8.

Pods 25-80 × 8-15 mm.

Seeds 6-11 mm long, 2-4.

G. soja

(wild)

A distinct slender climber, thin

Leaves thin, never broader than 2.5 cm.

Flowers in axillary clusters of 1-3.

Pods 20-30 × 4-6 mm.

Seeds 4-5 mm long, 3-4, black.

There appears to be no report on record of *G. soja* being in Kashmir.

Herniaria incana Lam., *Encycl. Meth. Bot.* 3: 124, 1789; Boiss., *Fl. Orient.* 1: 741, 1867; Brummit and Heywood, *Flora Europaea* 1: 152, 1964; Brummit in Davis, *Flora Turkey* 2: 246, 1967.

H. hirsuta var. *incana* (Lam.) Hook. f., *Fl. Brit. India* 4: 712, 1885.

Perennial herb; branches several from semiwoody root-stock, prostrate, spreading, 10-40 cm long. Leaves obovate-lanceolate, 5-10 mm long, upto 4 mm broad, narrowed towards base, densely hirsute with white hairs, lower leaves opposite upper alternate; stipules 1.5-2 mm long, membranous, ovate-lanceolate, hairy especially on margins. Flowers subsessile in axillary clusters of 3-7; bracts nearly more than half the length of calyx. Calyx ovoid, densely hirsute without, ca 2 mm long, lobes oblong, margins scarious. Stamens 5, filaments dilated below; anthers yellowish brown. Style very short. Fruit an indehiscent utricle, included within the calyx.

Habitat: Dry rocky slopes.

Flowers: April-July.

This is rather the common species found on rocky slopes of Kasmir and evidently has gone under the name of *H. hirsuta* L., a rather distinct species with annual habit and dense clusters of flowers. Both these species grow in Kashmir, but recorded only under the name *H. hirsuta* L.

Lactuca runcinata DC. in Wight, Contrib. 26; Wealth of India 6:15, 1962.

L. heyneana, DC., Prodr. VII: 140, 1838; Hook, f., Fl, Brit, India 3:403, 1881.

Annual or biennial herb, 20-80 cm tall rigid, branched usually from near the base. Radical leaves many, 8-25 cm long, runcinate-pinnatifid; terminal lobe largest; margins with sharp spinulose teeth; base narrowed; cauline leaves few, distant, usually entire, less than 1 cm long, linear. Heads on long slender branches, subtended by narrowly linear bracts, solitary or few together on 4-12 mm long stalks; heads 10-14 mm long. Flowers all ligulate, yellow. Invol. bracts 2-seriate, outer very small, 2-3 mm long, inner long with membranous margin, 9-13 mm long. Ligules yellow, truncate, 5 toothed. Achenes 2-3 mm long, shortly beaked, muricate; pappus soft, silky, 7-10 mm long.

Locality: Pampore saffron fields, Kashmir University Campus.

Flowers: May-July.

Lathyrus sphaericus Retz., Obs. 3: 39, 1785; Hook. f., Fl. Brit. India 2: 180, 1876.

Annual herb, glabrous, much branched, climbing by long tendrils; stems green, 1.5-2 mm across, leaflets 2, narrowly linear towards both ends, 5-8 cm long, upto 5 mm broad; stipules linear, 1-1.5 cm long, base auricled, auricles acute, 3-5 mm long; petiole 12-18 mm long, ending into a long usually unbranched tendril. Peduncles axillary, 8-25 mm long, ending into a long usually unbranched tendril. Peduncles axillary, 8-25 mm long, single flowered, produced into a tendril (bracteole). Calyx tube 2.5-3 mm long, lobes linear 3-4 mm long, glabrous. Corolla 9-12 mm long, reddish; standard broad, keel shorter than the wings. Pod sessile, 4.5-6 cm long, linear. yellowish brown, beaked, 3-5 mm broad, nerves prominent reticulating. Seeds 9-12, chocolate brown, ovoid-subspherical, ca 2.5 mm.

Habitat: Among scrubs.

Flowers: May-June.

Blatter (1927) who included the genus *Lathyrus* in his "Beautiful Flowers of Kashmir" and recorded all species found in Kashmir, does not record this species. There is also no other report of this species from the valley. In India the species is found in Northwest India at lower altitudes often ascending to 1,700 m. In its distribution the species ranges from West Asia, North Africa to Europe.

Linum strictum L., Subsp. **corymbulosum** (Reichenb.) Rouy, Fl. Fr. 4: 60, 1897; Ockendon & Walters, Flora Europaea 2: 210, 1968.

L. corymbulosum Reichenb., Fl. Germ. Excurs. 843, 1832; Boiss., Fl. Orient. 1: 852, 1867.

L. strictum L., var. *corymbulosum* (Reichenb.) Planch., in Hook. Lond. Journ. Bot. 7: 476, 1848; Hook. f.

Fl. Brit. India 1: 411, 1874.

Annual herb, 10-20 cm tall, corymbosely branched, almost glabrous. Leaves linear-lanceolate, 1-1.5 cm long, 2-3 mm broad, margins rough, minutely serrulate, apex sharply pointed; stipules absent. Flowers in corymbose cymes. Pedicels slender upto 4 mm long. Sepals lanceolate, broadened towards the base, apex acuminate, margins with stalked glands towards the top; sepals 4-6 mm long. Petals yellow, 6-10 mm long, obovoid, shortly clawed. Stamens 5, alternating with 5 minute teeth like staminodes; filaments slightly flattened and united into a staminal ring; anthers yellow. Style almost equalling the stamens; stigmas globose yellow. Capsule globose, 2-3 mm across, beak scarcely 1 mm. Seeds 1.2-1.5 mm long, ovoid, flattened.

Locality : Mountain slopes around Manasbal Lake, fairly common.

Flowers : May-June.

Parietaria debilis Forst. f., Fl. Inst. Austral. Prodr. 73, 1786; Hook. f., Fl. Brit. India 5. 593, 1889.

Flaccid annual herb, pubescent, 8-20 cm long. Leaves alternate, ovate-oblong or obovate-orbicular, 8-20 mm long, three nerved from base, exstipulate. Flower axillary in clusters of 2-5, pedicels 3-5 mm long, deflexed in fruiting. Bracts linear, connate below. Perianth green, 1.5-2 mm long in fruit, lobes 4, patent not connivent. Stigma in female flowers a tuft of hairs. Perianth persisting enclosing the achene. Achene apiculate, asymmetrical.

Habitat : Below rocks at higher altitudes.

Flowers : July-September.

This species is well distributed in temperate Himalayas, mountains of South India and wide spread in temperate and tropical regions of southern hemisphere. There is, however, no report on record of this species from Kashmir.

Senecio vulgaris Linn. sp. 867, 1753 ; Butcher New Ill. Fl. Brit. II : 436, 1961.

An annual herb ; stem erect or decumbent, little branched often rooting at lower nodes 12-25 cm high ; Leaves alternate, pinnatifid, upper with auricled base, lower narrowed to a petiole; Heads in corymbs, nearly 1 cm long, 3-5 mm in diameter; Involucre bracts linear with black tips, one seriate with few outer smaller ones ; Receptacle flat, naked ; Heads discoid, hirsute, apex truncate, pappus of soft hairs, deciduous.

Orchards around Dal lake Harwan fls. Nov.-May.

The species is close to *S. pedunculatus* Edgew. and *S. coronopifolius* Desf. in general habit but is distinguished by the absence of ligules and the hirsute achenes. This is another introduced weed also having run wild in gardens and roadsides in Nilgiris (*Gamble*, 1921). Predominantly a winter weed it has the distinction of being the only weed that manages to flower throughout the winter months of Kashmir Valley. It has fairly spread in cultivated gardens and orchards in and around Srinagar.

Solanum surattense Burm. f., Fl. Ind. 57, 1968.

Solanum xanthocarpum Schrad. & Wendl. Ser-Hanov. 1 : 8. t. 2, 1795; C.B. Clarke *Fl. Brit. Ind.* 4 : 236, 1883,

A spreading armed herb; stem prickly, prostrate, branched; rough with hairs at least when young; leaves alternate oblong, pinnatifid, 5-10 cm long, armed with prickles on both sides on the mid-rib and veins, prickles pale yellow, straight, 2-4 cm long, petiole 1.5-3 cm long; flower bluish. 2-3 cm diameter singly or in short cymes; calyx prickly, 4-7 mm long, lobes ovate oblong corolla hairy without, lobes short; fruit a berry, pale yellow with green blotches, 1.2-2 cm in diameter.

Locality : Bank of River Jehlum near tourist reception centre.

Flowers : August-November.

The plant is fairly common all over India usually at altitudes below 1500 m, but often reaching 2400 m. There is however no collection on record from Kashmir Valley.

Tagetus minuta Linn. sp. Pl. 887, 1753; Nair & Pant, *Bull. Bot. Surv. Ind.* 8 (1): 77, 1966.

An autumn flowering, strong smelling, grooved annual herb variable in height often reaching 3 m; leaves opposite or alternate often both types on same plant, odd pinnate, 5-15 cm long; leaflets usually 13-17, linear lanceolate, sharply serrate, serrations interrupted, margins dotted with yellowish glands, leaflets 2-5 cm long, filiform dissected lobes near the base of petiole; heads many, crowded together at the ends of branches, 1.2-1.8 cm long; involucre bracts united into a tube with short five free lobes, yellowish green; ray florets usually 2 or 3, rarely 4, pale yellow to almost white, obcordate; disc florets 3-6, deeper yellow, lobes small; achenes linear lanceolate, black 6-10 mm long with appressed golden yellowish hairs; pappus 2-4 mm long of unequal scales.

Locality : University Campus.

Flowering : October-November.

This is a native of South America and probably introduced in India. The plant was first reported from N.W. Himalayan region of India from several regions but not from Kashmir, by Nair & Pant (1966). The rapidity with which the plant has spread in the University Campus suggests the possibility of rapid colonisation of the plant in Kashmir Valley.

The plant has also been collected by me from other regions of Jammu & Kashmir State including Kud, Poonch and Swaran Kot.

Trifolium dubium Sibth. Fl. oxon. 231, 1794 ; Gamble Fl. Pres. Madras 214, 1918 (Rep. eq. 1967) (*T. minus* Smith, Engl. Bot. Pl. 1256, 1799 ; Baker in Hook. f. Fl. Brit. India 2 : 86, 1876 ; Collett Fl. Simlensis 116 , 1922.

An annual herb ; branching usually from base, slender trailing, ultimately erect ; leaflets obovate or obcordate, finely toothed 0.5-1 cm long ; terminal leaflet with hardly 2 mm long stalk ;

petiole 0.6–1 cm ; stipules lanceolate 2.5–4 mm long ; flower heads yellow on axillary 1.0–2.5 cm long peduncles, 0.4–0.8 mm diameter ; calyx teeth very small, narrow, acute ; corolla hardly 3–4 mm long pod obovoid, one seeded; seed yellowish brown.

Harwan Park, fls. April-June.

This species is easily distinguished from other Indian species by its smaller yellow heads and annual habit. As an introduced weed it has also run wild in Nilgiri Hills (Gamble, 1918), and Simla (Collett, 1921).

NOMENCLATURE NOTES

Rubus ulmifolius Schott.

In the treatment of the genus *Rubus* in the "Flora of British India", J. D. Hooker (1878) indentified certain Himalayan specimens of the genus with *R. discolor* Weihe & Nees, and reduced it to a variety: *R. fruticosus* var. *discolor*. Brandis (1906, 1921), though observing "this is *R. discolor* Weihe and Nees" identified this plant under *R. fruticosus* L., the same identification having been followed by Parker (1918), and Lambert (1933).

A critical examination of Indian specimens identified thus revealed that these are different from both *R. fruticosus* L. and *R. discolor* Weihe & Nees. The Indian specimens, together with those from our area, belong to the closely related species *R. ulmifolius* Schott., which is specifically distinct from both the above species which are not represented in India. These three species are easily separated as under:

<i>R. ulmifolius</i>	<i>R. discolor</i>	<i>R. fruticosus</i>
Stems arching, pruinose.	Stems arching, sparsely hairy or glabrescent.	Stems erect, glabrous.
Leaflets 3-5, dark green and glabrous above, white tomentose beneath.	Leaflets 5, glabrous above, white tomentose beneath.	Leaflets 3, green on both sides, finally glabrous above, pubescent beneath.
Flowers rosy or white	Flowers rosy or white,	Flowers rosy or white.

in long panicles.	in large pyramidal panicles.	in few flowered corymbs.
Stamens equalling or just exceeding the styles, anthers glabrous.	Stamens much exceeding the styles, anthers pubescent.	Stamens about equalling the styles.

The Indian taxon should thus better be known as *R. ulmifolius* Schott., and the correct nomenclature of this should be:

Rubus ulmifolius Schott., in Oken Isis fasc. 5: 821. 1818; Rehder; Man. Cult. Trees and Shrubs 418, 1940; Heslop-Harrison, Flora Europaea 2:6, 1968; Kitamura, Fl. Afgan. 183, 1960. *R. fruticosus* var. *discolor* Hook f., Fl. Brit. India 2: 337. 1878. *R. fruticosus* auct. (non L.); Brandis, Indian Trees, 1906.

Rosa brunonii Lindl.

In his monograph on the genus *Rosa*, Lindley (1820) described a Himalayan species under the name *R. brunonii*, which subsequently figured in Don's "Prodromus Florae Nepalensis..." in 1825; and appeared as *R. brunonis* in Wallich's Catalogue. Royle (1839) also followed the latter name. Brandis (1874) merged it with *R. moschata* Hermn., and the Indian specimens went under this name in the works of Hooker (1878), Brandis (1906, 1921), Parker (1918), Collett (1921), Rao (1960), etc. A close examination of the taxa collected from our area revealed that the majority of specimens agree with *R. brunonii* Lindl., and that a few specimens identify with *R. moschata* Hermn.; and that the two are quite distinct to justify their recognition as separate species. The Indian specimens, thus, should go under these two distinct species and not lumped together under *R. moschata* Hermn., as done in most Indian works. Certain authors including Kitamura (1960) and Rehder (1940) also treat them as separate species. These are separated as under:

R. moschata

Leaves elliptic-ovate or oblong, 2.5-5 cm long.
Leaflets glabrous or nearly so beneath except the midrib, petioles and rachis nearly glabrous.
Flowers in few flowered corymbs (usually less than 10).

R. brunonii

Leaves elliptic-oblong or oblong-lanceolate, 3-6 cm long.
Leaflets softly pubescent beneath, petioles and rachis pubescent.
Flowers in many flowered corymbs (usually more than 10).

Rosa brunonii Lindl., Monogr. Rosa 120, t. 14, 1820: Don, Prodr. Fl. Nep. 236, 1825; Rehder, Man. Cult. Trees and Shrubs 446, 1940.

R. brunonii Wall., Cat. 689 (Nom. nud.).

R. moschata Hook. f., Fl. Brit. India 2: 367, 1878 (pro parte).

R. moschata Brandis, For. Flor. 201, 1874 (pro parte).

***Padus cornuta* (Wall. ex Royle) Carr.**

This Himalayan bird cherry, first named *Cerasus cornuta* by Wallich, was described and illustrated in Royle's "Illustrations of Botany of Himalayan Mountains....." in 1835. Steudal (1841) transferred it to the genus *Prunus* under the name *Prunus cornuta* and this has been followed in several works including those of Parker (1918), Lambert (1933), Rehder (1940), Bor (1953), Rao (1960), and Gupta (1968). Brandis while keeping this in the genus *Prunus* merged it with the European bird cherry, *P. padus* L., and the same nomenclature has been followed by Hooker (1878), Brandis (1906, 1921), and Collett (1921). The genus *Padus* was recognised by Borckhausen (1794) and Carriere (1869) transferred *Prunus cornuta* to this genus under the name *Padus cornuta*. Hutchinson (1964) separated the species placed under section *Laurocerasus* in "Genera Plantarum" of Bentham and Hooker (1865), under two genera *Padus* and *Laurocerasus*, as distinct from genus *Prunus*, and included both *Prunus padus* and *P. cornuta* under the genus *Padus*, thus also recognising them as separate species. In view of the marked differences between these two species, it appears advisable to regard them as distinct species under the names *Padus racemosa* (syn. *Prunus padus* L.) and *P. cornuta* (syn. *Prunus cornuta* Steud.), being the European bird cherry and the Himalayan bird cherry respectively. These two are separated as under:

Padus racemosa

Leaves sharply serrate, 6-12 cm long, petiole 1-1.5 cm long.

Flowers 10-15 cm across, petals twice as long as stamens.

Calyx tube pubescent within.

Stone of fruit sculptured.

Padus cornuta

Leaves serrulate, 8-20 cm long, petiole 1.5-3 cm long.

Flowers 6-9 mm across, petals equalling or slightly exceeding the stamens.

Calyx tube glabrous within.

Stone smooth or slightly rugose.

Hutchinson (1964), while recognising 27 species in the genus *Padus*, considered *Prunus cornuta* Steud. as the basionym for specific combination *Padus cornuta* (Steud.) Carr., overlooking the earlier valid publication of *Cerasus cornuta* in Royle's work. The true nomenclature of the Himalayan bird cherry should thus be as under:

Pudus cornuta (Wall. ex Royle) Carr., in Rev. Hortic. 275, f. 64, 1869.

P. cornuta (Steud.) Carr.; Hutchinson, Gen. Fl. Plants 1: 188, 1964.

Cerasus cornuta Wall. ex Royle, Ill. Bot. Himal. 207, t.38, f. 2, 1835.

Prunus cornuta (Wall. ex Royle) Steud., Nom. Bot. ed. 2, 2: 403, 1841; Rehder, Man. Cult. Trees and Shrubs 479, 1940; Gupta, Fl. Nainitalensis 110, 1968; CSIR, Wlth. India 8: 268, 1969 (figure erroneously of *Prinsepia utilis* Royle).

Prunus padus Brandis, For. Flor. 194, 1874 (non L.): Hook. f., Fl. Brit. India 2: 315, 1878; Brandis, Indian Trees 281, 1906; Collett. Fl. Simlensis 156, 1921.

***Sambucus wightiana* Wall. ex Wight & Arnott**

The tall herbaceous *Sambucus* which grows so abundantly in the valley of Kashmir was referred to as *S. ebulus* by C.B. Clarke in "Flora of British India." though pointing out that Kashmir specimens have many rayed corymbs as against three rayed Europæan ones. This nomenclature has been followed by most Indian authors including Duthie (1894), Brandis (1906), Parker (1918), and Rao (1960). Wettstein (1890) described a new species under the name *S. gautschii* and referred all Kashmir collections to it. Hutchinson (1909) on examination of the type specimen of *S. wightiana* Wall. ex Wight & Arnott, which was unfortunately wrongly placed as a synonym of *S. javanica* Blume by C. B. Clarke, decided that this is nothing other than the common Kashmir plant having gone under the name *S. ebulus* in "Flora of British India," and which is specifically distinct from this latter species. He suggested, that being an earlier valid name, *S. wightiana* Wall. ex Wight & Arnott should be used for the Indian specimens hitherto referred to as *S. ebulus*. A recent examination of Indian and Europæan specimens at Dehra Dun and Calcutta herbaria revealed that Europæan *S. ebulus* L. and Himalayan *S. wightiana* Wall. ex Wight & Arnott

are quite distinct, and that former is not represented in India. The Indian specimens appear more closer to *S. adnata* Wall. which can, however, be separated in its scrubby habit, small stipules and pubescent inflorescence. *S. ebulus* L. and *S. wightiana* Wall. ex Wight & Arnott can be separated as under:

S. wightiana

Leaflets 5-1.

Lower leaflets sessile or subsessile, upper decurrent, margins with sharply pointed teeth.

Branches of inflorescence 5 or more, not leafy at the base.

Flowers 3-5 mm across. never tinged with red.

Stamens spreading filaments not dilated below, anthers yellow.

Fruit orange red.

S. ebulus

Leaflets 1-13.

Lower leaflets stalked, upper never decurrent, teeth not sharply pointed.

Branches of inflorescence usually 3, leafy at the base.

Flowers 8-10 mm across, usually tinged with red.

Stamens erect, filaments dilated below, anthers purple.

Fruit black.

In view of these marked differences it seems advisable to treat the Indian specimens as distinct from European *S. ebulus* L. and to adopt *S. wightiana* Wall. ex Wight & Arnott as the valid name for the Indian specimens. The Indian taxon should thus have the following nomenclature:

Sambucus wightiana Wall. ex Wight & Arnott, Prodr. 388, 1834; Hutchinson, Kew Bull. 191-193, 1909.

S. ebulus Clarke, in Hook. f. Fl. Brit. India 13:2, 1880 (non L.); Parker, For. Fl. Punjab etc. 275. 1918. Brandis. Indian Trees 364, 1121. *S. gautschii* Wettst, in Oest. Bot. Zeitschr. 40:230, t. 2, 1890.

Ranunculus distans Royle

Wallich named a Himalayan species of *Ranunculus* as *R. laetus* in his Catalogue. This specific name was, however, not validated until published with description by Royle (1834), who also described another species *R. distans* from "mountains towards Cashmere". J. D. Hooker and T. Thomson (1872) merged the two species adopting *R. laetus* Wall. as the valid name. The new species names in Wallichian Catalogue, as understood now, being considered as *Nomen nudum*, the name *R. distans* Royle should be applied for the plant having gone

under the name *R. laetus* in "Flora of British India," on the basis of priority.

Ranunculus distans Royle, Ill. Bot. Himal. 53, 1834.

R. laetus Wall. ex Royle, Ill. Bot. Himal. 53, 1834.

R. laetus Wall. ex Hook. f. & Thoms., Fl. Brit. India 1: 19, 1827; Ovchinnikov in Komarov, Fl. U.S.S.R. 7. 472, 1937; Tamura in Kitamura, Fl. Afghan. 130, 1960.

Valerianella muricata (Stev.) Baxt.

C. B. Clarke (1881) in "Flora of British India" reported two species of genus *Valerianella* from Kashmir: *V. szovitziana* Fisch. & Mey. and *V. dentata* Poll. A recent comparison of collections of Thomson and subsequent explorers in Forest Research Institute Herbarium, Dehra Dun and Central National Herbarium, Calcutta, together with the collections made by the authors from Kashmir valley, and a closer scrutiny revealed that though specimens of *V. szovitziana* (Cf. Chawal village, Kashmir, Gammie; Ziarat, Beluchistan: Anderson No. 6; both in F. R. I., Dehra Dun) are correctly placed, those identified with *V. dentata* Poll. differ considerably from the European specimens. These specimens identify with *V. truncata* (Rchnb.) Betke (based upon *Fedia truncata* Rchnb.), which is rather more closer to *V. eriocarpa* Desv. in having broader net veined calyx. *V. truncata*, however, differs from *V. eriocarpa* proper in having obliquely truncate calyx without prominent teeth, and being open on one side. *V. dentata* Poll. differs in having taller habit, calyx in fruit being very narrow: being less than half as broad as fruit, prominently toothed, and the fruit usually glabrous.

C. B. Clarke, while identifying the Kashmir specimens with *V. dentata* Poll., regarded *V. morisoni* Spreng., and *V. microcarpa* Loisel, figuring in Boissier's "Flora Orientalis" (1875) as synonyms of this species, overlooking *V. truncata* (Rchnb.) Betke also figuring in the same work as distinct species.

Opinions differ as to the nomenclature of *V. truncata*, but it is now regarded as a synonym of *V. muricata* (Stev.) Baxt. by majority of the workers. The name *V. muricata* should thus be

taken to replace the name *V. dentata* as applied to Indian plants (and not the European *V. dentata* Poll.). *V. dentata* Poll. does not occur in India, and the specimens misidentified thus in "Flora of British India" should be named as *V. muricata* (Stev.) Baxt. with the inclusion of the following specimens:

Central National Herbarium, Calcutta:

Bundai, Chitral: Harris No. 16232; Kagan valley, Hazara: Inayat No. 21842; Himal Bor.: T. Thomson.

Forest Research Institute Herbarium, Dehra Dun:

Kagan valley, Hazara: Inayat No. 19653; Rati, Kashmir: Rashid Khan No. 27383.

Kashmir University Herbarium, Srinagar:

Kashmir University Campus, Srinagar: Gurcharan Singh No. 3729; Harwan, Kashmir: Gurcharan Singh No. 754; Kashmir University Campus, Srinagar: G. N. Javid No. 715; Shankeracharya, Srinagar: G. N. Javid No. 739.

The nomenclature of Indian plant should thus be as under:
Valerianella muricata (Stev.) Baxt., in London Hort. Brit. Suppl. 3:654, 1839; Rechinger, Fl. Lowland Iraq 574, 1964 et in Flora Iranica 62:16, 1969; Coode and Mathews in Davis, Fl. Turkey 4: 581, f. 17.15, 1972; Stewart in Nasir & Ali, Fl. West Pakistan 699, 1972.

Fedia muricata Stev. in Roem.-Schult. Syst. Veg. 1: 366, 1817.

Valerianella truncata var. *muricata* (Stev.) Boiss., Fl. Orient. 3: 106 1875. Nomen illegit.

V. truncata (Rchnb.) Betke, Animadv. Val. 22, 1826.

V. dentata Clarke in Hook. f., Fl. Brit. India 3: 214, 1881 (non Poll.); Javid, Fl. Srinagar 1: 661, 1970; Stewart in Nasir & Ali, o. c. 699.

V. eriocarpa Desv. var. *truncata* (Rchnb.) Loret & Barrandon, Fl. Montellier 311, 1876.

V. eriocarpa Desv. subsp. *truncata* (Rchnb.) Burnat, Fl. Alpes Marit. 5: 208, 1913.

Fedia truncata Rchnb., Fl. Crit. 2: 7, tab. 115, f. 225. 1824.

***Artemisia indica* Willd.**

Artemisia indica first named by Willdenow (1803), figured subsequently in the works of Roxburgh (1832), DeCandolle (1836) and Wight. Sir J.D. Hooker on examination of Indian

specimens merged the species including *A. indica* Willd., *A. grata* Wall., etc., with European *A. vulgaris* L. An examination of the Indian specimens under *A. vulgaris* revealed that in addition to common Indian species; now known as *A. nilagirica* (Clarke) Pamp. since *A. vulgaris* L. does not grow in India, certain specimens identify with *A. indica*, which are quite distinct. Both *A. indica* and *A. dubia* of this complex occur in Kashmir, as also in our area, and the close examination of two suggests that these are quite distinct to justify their recognition as separate species.

Artemisia indica Willd., Sp. Pl. 3: 1846, 1803; Roxb., Fl. Ind. 3: 419, 1832; DC., Prodr. 5: 114, 1836; Wight, Ic. Pl. t. 1112.

A. vulgaris sensu Hook f., Fl. Brit India 3: 325, 1881 (pro parte).

Perennial herb, 1-2 m tall, branched above. Leaves once or twice pinnatifid, lobes narrow, lanceolate, upper most leaves entire, glabrous above, greyish sparsely hairy or glabrescent beneath. Heads numerous in panicles; panicles leafy, spreading; heads pale yellowish green, ca 2 mm across, ovate, narrower; involucre bracts finally glabrous, outer acute, inner obtuse, prominently scarious.

A. dubia Wall is distinguished by densely tomentose under surface of leaves, leaves being less dissected with broader lobes and heads being few in number, ca 3 mm across, darker yellow and broader above.

Origanum normale Don

While revising the genus *Origanum* for India, J.D. Hooker (1885) merged, among others, the specimens described under *O. normale* Don by earlier authors, with the European *O. vulgare* L., remarking "*O. normale* Don has usually smaller, less coloured bracts, but intermediates are very common". Mukerjee (1940) in his "Revision of the Labiatae of Indian Empire" also recognised *O. vulgare* L. as the only valid Indian species evidently merging *O. normale* with it.

Origanum normale was first named and described by D. Don (1825) and subsequently appeared in the works of Bentham

(1831, 1834) and DeCandolle (1848). Boisser (1879) considered it as a variety of *O. vulgare* L.

A close examination of numerous Indian specimens revealed that though there are certain specimens in Central National Herbarium, Calcutta (Kolohai valley above Lidderwat, Kashmir: Duthie No. 13500; Kashmir: Levinge No. 27166) and Forest Research Institute Herbarium, Dehra Dun (Pir Panjal, Kashmir, 11000': Gammie; above Lidderwat, Kashmir: Duthie No. 13500), that can be referred to *O. vulgare* L., a large collection of specimens identifies with *O. normale* Don, and that, the two are quite distinct so as to justify the recognition of latter as a distinct species.

Origanum normale Don, Prodr. Fl. Nep. 113, 1825; Benth. in Wall., Pl. As. Rar. 1: 31, 1831; Benth., Lab. Gen. et Sp. 335, 1834; Benth. in DC., Prodr. 12: 193, 1848.

O. vulgare var. *viride* Boiss., Fl. Orient. 661, 1879.

O. vulgare Hook. f., Fl. Brit. India 4: 648, 1885 (pro parte).

Perennial herb with creeping rootstock; stems several, some outer ones vegetative; flowering shoots 20-80 cm tall, aromatic, branches angled, hairy. Leaves ovate-oblong, 1.5-3 cm long, hairy on nerves beneath, glandular dotted on both surfaces, more conspicuously above; petiole 3-6 mm long, densely hairy, internodes 3-5 cm long, lower leaves often crowded due to axillary reduced sterile shoots. Flowers 3-6 together in cymose heads at the ends of upper most branches, bracts green, 4-5 mm long, 2.5-3 mm broad, oblanceolate or lanceolate, sparsely glandular dotted, pedicels ca 1 mm long, hairy, calyx tube 2-2.5 mm long, almost glabrous with few hairs near the base, glandular dotted more conspicuously above; lobes ca 1 mm long, ovate-lanceolate, calyx densely hairy within, green. Corolla 3.5-4.5 mm long, white, ca 2.5 mm across, hairy without. Anthers purple-violet, style exserted. Nutlets 0.7-0.9 mm long, brown, ovoid, narrowed suddenly at base.

In its distribution *O. vulgare* L. is usually confined to altitudes above 2,800 m in Kashmir valley while *O. normale* Don commonly ranges between 1,200-2700 m altitude in the

Himalayan region. The two species can be separated as under.

O. normale

Plants usually lighter green.

Leaves ovate oblong.

Cymes elongating after flowering.

Bracts green, oblanceolate or lanceolate, 4.5 X 2.5-3 mm.

Corolla 4-5 mm long, ca 2.5 mm across, white.

O. vulgare

Plants usually darker green.

Leaves usually ovate.

Cymes usually condensed after flowering.

Bracts purple, ovate. 5-7 X 4-5 mm.

Corolla 6-7 mm long, 3-3.5 mm across, rose-purple.

***Iris nepalensis* Wall.**

Wallich (1824) named and described a bearded species of *Iris* as *I. nepalensis*, a name which was subsequently applied to a quite distinct beardless species by D. Don (1825), for which Wallich (1831) supplied another name *I. decora*. *I. nepalensis* Don, being thus a later homonym of one described earlier under that name by Wallich, should have been rejected in favour of *I. decora* Wall., as rightly done by Royle (1839) and followed by Gupta (1968), but Sir J.D. Hooker (1892) was doubtful regarding the identity of *I. nepalensis* Wall., adopted *I. nepalensis* Don as the valid name for beardless species.

I. nepalensis Wall., thus deserves recognition as valid name for the bearded species also having gone under the name *I. deflexa* Knowls & Wetc. Since *I. nepalensis* Don, is a later homonym it should be rejected and *I. decora* Wall., should be adopted as the valid name for beardless species. The nomenclature of the bearded species which is rather closer to *I. kashmirianus* Baker but distinct in stalked lilac flowers on deflexed stems should be as under:

Iris nepalensis Wall. ex Lindl., in Bot. Reg. t. 818, 1824; Royle, Ill. Bot. Himal. 372, t. 90, f. 2, 1839.

I. deflexa Knowls & Wetc., Flor. Cab. 2: 19, t. 57, 1838; Hook. f., Fl. Brit. India 6. 275, 1892.

SPECIES NOVO

Tragopogon kashmirianus Gurcharan Singh sp. nov. Fig. 4.

Species *Tragopogon mirus* Ownbey subsimilis sed distat: ligulae purpureo striatae, phyllariis 8-11 margine scariosus, pappus setis cervino, plume cinereo.

Herba biennis, 25-60 cm alta, glabriuscula. Folia linearie basi dilatata, sensim angustata, ad 25 cm longa. Calathia pedunculis inflatis. Phyllariis lineari-lanceolatis, margine scariosus, 8-11, 4-6 cm longa. Ligulae 20-25 mm longae, luteae, purpureo-striatae. Antherae 3-4 mm longae, basi luteae, parte superiore violacea. Achaenia cinereo-brunnea, 13-16 mm longa, in rostrum 12-20 mm longum sensim abeuntia, exteriora interiora glabra. Pappus 25-40 mm longis, cervino, basi connatis annulum lanatum formantibus, plume cinereo,

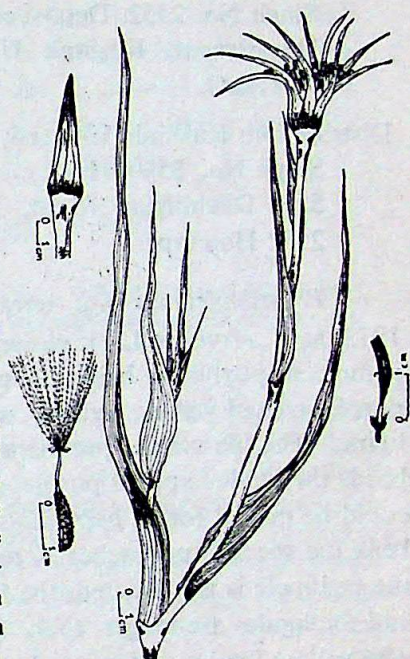


Fig. 4. *Tragopogon kashmirianus* Singh

Holotypus : In silva Dachhigam, Kashmir, alt. 1,700 m. Gurcharan Singh No. 2552. In Herbario Departmenti Phytologiae, Universitatis Kashmiriensis, Srinagar conservatur.

Biennial herb, 25-60 cm tall, almost glabrous, simple or branched. Leaves linear, gradually narrowed above from dilated base, upto 25 cm long, upper successively smaller. Heads solitary on inflated peduncles. Phyllaries 8-11, 4-6 cm long, margins scariosus. Ligules 20-25 mm long, yellow, purple striated. Anthers 3-4 mm lower half yellow, upper violet. Flowers closing during day but open in morning and in dull weather during day. Achenes greyish brown, 13-16 mm long, gradually narrowed to 12-20 mm long beak. Pappus bristles tawny, straight, plumose except for naked distal end, 25-40 mm long, united below into a disc; disc wooly. Fruiting heads 7-9 cm across, pappus hairs ashy. $2n = 24$.

Holotype: Dachhigam forest, Kashmir, alt. 1,700 m : Gurcharan Singh No. 2552. Deposited in the Herbarium of Botany Department, Kashmir University, Srinagar. Isotype in N.Y.B.G.

Distribution: Kashmir University Campus, Srinagar; Gurcharan Singh No. 3580; Harwan. Kashmir: Gurcharan Singh No. 553; Dachhigam forest, Kashmir: Gurcharan Singh No. 2552 Holotype.

T. kashmirianus is a tetraploid species (Koul and Gohil, 1972: as *T. pratense* L.) is closer to *I. porrifolius* L. in swollen peduncles, phyllaries being longer than ligules, but differs in purple striated yellow ligules, stouter beak and ashy pappus hairs. The flowering specimens of *T. kashmirianus* of closed heads the ligules appear purple, and many a times the specimens could be missed for *T. porrifolius* L. in yellow ligules and stouter beak the species approaches *T. pratensis* L., in which, however, the peduncle is not inflated, the ligules are not purple streaked and the ligules are longer than the phyllaries. *T. dubius* Scop. with yellow ligules and inflated peduncle appears more closer to *T. kashmirianus*, but does not have purple striations on ligules, phyllaries are usually up to 13 in number, ligules often more than 30 mm long and pappus hairs are whitish. All the three species: *T. pratensis*, *T. dubius* and *T. porrifolius*, also differ in being the diploids.

Ownbey (1950) observed that as a result of natural hybridization and amphiploidy in genus *Tragopogon* two new amphiploides have arisen in southeastern Washington and adjacent Idaho and he recognised them as distinct species *T. mirus* Ownbey (*T. dubius* × *T. porrifolius*) and *T. miscellus* Ownbey (*T. dubius* × *T. pratensis*), both of which like *T. kashmirianus* are tetraploid species. *T. miscellus* is distinct species having purple margined phyllaries, upto 13 in number, yellow ligules about equalling the phyllaries in length. *T. mirus*, though much closer to *T. kashmirianus* is distinct in bicoloured ligules being lilac in upper half and yellow in lower half, phyllaries upto 13 in number and pappus being tawny coloured. *T. mirus* is an amphiploid between *T. dubius* and *T. porrifolius*, and the

combination of characters suggests that the same two species must have participated in the evolution of *T. kashmirianus*. Natural hybridization between these two diploid parents has already given rise to two distinct species: *T. phaeus* Focke (1907) and *T. mirus* Ownbey (1950), and *T. kashmirianus* may probably be another result of the same parental combination.

***Galium mahadivensis* Gurcharan Singh sp. nov.**

Proxime affinis *G. confertum* Royle, a qua tamen differt gracili repenti caudice, folia apice acutis, marginibus recurvatis, pedunculi saepissime 3 flores ed pilis fructus strictus.

Perennis, caule plures, 5-15 cm alta ex gracili repenti caudice orientes, ascendentes plus minusve suberecti, quadriangula; patente pilosa, anguli antescabridis. Folia saepissime 4 in verticello, lanceolata, basi petiolum 1-2 mm longum contracta, uninervia, marginibus recurvatis, apice acutis, marginibus costaque subtus scabrida, 4-9 mm longa. Pedunculi axillares, 3-8 mm longi, saepissime flores 3, ad pedicellis 2-5 mm longis gerentes. Flores ca 1.5 mm in diametro, albid. Corolla 4 loba, lobis ovato-lanceolatis acutis. Fructus siceus 1.5-2 mm latus, pilis strictus 2.5-3.5 mm longis vestitus.

Holotypus: In silva Dachhigam. Kashmir, alt. 2,200 m. Gurcharan Singh No. 3172. In Herbario Departmenti Phytologiae, Universitatis Kashmiriensis, Srinagar conservatur.

Perennial herb; stems several, 5-15 cm tall from a slender creeping rootstock, ascending to suberect, 4 angled, spreading hairy, angles anterorsely scabrid. Leaves in whorls of 4, lanceolate, single nerved, narrowed below to 1-2 mm long petiole, margins recurved, sparsely anterorsely scabrid especially on margins and midrib beneath, 4-9 mm long. Flowers on axillary usually 3 flowered peduncles, peduncles 3-8 mm long. Pedicels 2-5 mm long, scarcely curved. Flowers ca 1.5 mm across; whitish. Corolla lobes 4, ovate-lanceolate, apex acute. Stamens 4. Fruit dry, 1.5-2 mm across, covered all over with 2.5-3.5 mm long hairs with straight tips.

Holotype: Dachhigam forest, Kashmir, alt. 2,200 m: Gurcharan Singh No. 3172. Deposited in the Herbarium of Botany Department, Kashmir University, Srinagar.

Galium mahadivensis is rather closer to *G. confertum* Royle from which, however, it differs in slender rootstock, acute leaf apex, recurved margins of leaves and usually 3 flowered peduncles. Straight tips of hairs on mericarps are distinctive for *G. mahadivensis*.

***Gentiana harwanensis* Gurcharan Singh sp. nov. Fig. 5**

Proxime affinis *G. aquatica* L., a qua tamen differt caule simplici. folia basalia oblongo-obovata, flores subsessilibus, calyx lobi oblongo, corolla lobulis intermediis basi bidentatus, pedicello capsula minoribus.

Annua, caule simplici vel supra ramosa. Folia basalia oblongo-obovata, 5-15 mm longa, apice rotundato vel mucronata; folia caulina subspathulata, apice rotundato, 5-11 mm longa, basi connata, margine scariosa. Inflorescentia capituliformis, floribus subsessilibus. Calyx tubo 3-5 mm lobis oblongis, margine scariosis. Corolla 7-11 mm in diametro, coerulea, efimbriata, lobis triangulari-ovatis, lobulis intermediis bifidus vel basi bidentatus. Capsula anguste obovata, apice rotundata vel subtruncata, 3-5 mm longa, pedicello subaequilongu, per totam longitudinem valvulis 2 dehiscens. Stylus vix 1 mm longus. Stigma capitatum. Stigma 10-20, brunnescentia, ellipticiobovata, 0.7-1.0 X 0.4-0.6 mm, superficie minute argenteoreticulata.

Holotypus : Harwan, Kashmir, alt. 1,700 m. Gurcharan Singh No. 1524. In Herbario Departmenti Phytologiae, Universitas Kashmiriensis, Srinagar conservatur.

Annual herb, usually simple, rarely branched above. Basal leaves obovate-oblong, 5-15 mm long, apex rounded or mucronate; cauline leaves subspathulate with rounded apex, 5-11 mm long, bases connate, margins scarious. Flowers forming a terminal head, almost sessile on main and lateral branches. Calyx tube 3-5 mm long, lobes oblong, margins scarious. Corolla 7-11 mm across, blue, lobes triangular-ovate, folds between lobes present, bifid at tip, with two basal teeth, fimbreae none. Fruit narrowly obovate, apex rounded or nearly truncate,

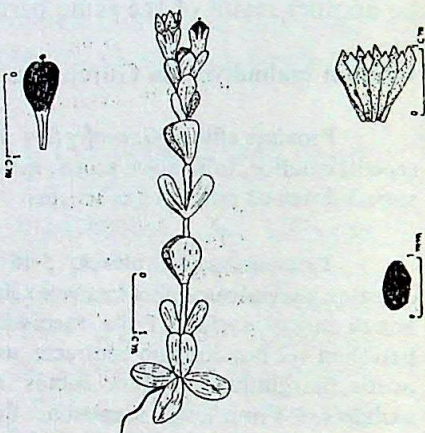


Fig. 5. *Gentiana harwanensis* Singh

fruit 3-5 mm long with nearly as long stalk, dehiscing throughout the length by two valves. Style hardly 1 mm long, stigma capitate. Seeds 10-20, chocolate brown, elliptic-obovoid, 0.7-1 mm long, 0.4-0.6 mm broad, surface with reticulated silvery thickenings.

Holotype ; Harwan, Kashmir, alt. 1,700 m ; Gurcharan Singh No. 1524. Deposited in the Herbarium of Botany Department, Kashmir University, Srinagar.

G. harwanensis

Radical leaves obovate-oblong.
Cauline leaves subspathulate with connate bases.

Pedicels hardly 2-3 mm long, calyx lobes oblong.

Folds between corolla lobes bifid with two additional basal teeth.

Stalk of capsule almost equaling the capsule, capsule shortly exserted.

G. aquatica

Radical leaves ovate.

Cauline leaves ovate or obovate.

Pedicels 4-12 mm long, calyx lobes lanceolate.

Folds between corolla lobes bifid usually without basal teeth.

Stalk often 3-4 times as long as the capsule, capsule long exserted.

In its distribution *G. aquatica* is confined to alpine region usually above 3,500 m, while *G. harwanensis* grows at an altitude of 1,700 m along drains in forest.

Some authors including Kitamura (1960) transfer some of the specimens identified as *G. aquatica* in "Flora of British India" to *G. pseudoaquatica* Kusnez., in Acta Horti petrop. 13, 4: 63, 1893, but the latter species differ in smaller leaves and reflexed mucro at the apex of leaves, as also longer stalked capsules.

Crepis dachhigamensis Gurcharan Singh sp. nov. Fig 7.

Species *Crepis sancta* subsimilis sed distat : folia radicalia 2-4, receptaculum nudus, achenia rigida longioribus, bractae rigida alevato costatus, longioribus.

Planta annua, caule simplici vel parce ramosa. Folia radicalia 2-4, petiolata, lamina oblanceolata vel lanceolata, pilosa, margine dentibus paucis; caulina pauca, lanceolata, 4-10 cm longa, basiauriculus acutis. Capitulis 10-15 mm in diametro, longe pedunculatis, pedunculus subglabris;

receptaculum dudum. Involucrum 2 seriatum, bracteis externis vix 2-3 mm longis, internis 8-14 mm longis, fructificandi tempore saepe ad 18 mm, costa elevata. Flores ligulati lutei. Achaenia anguste cylindrica, versus apicem angustata, rigida, 7-10 mm longa. Pappus albus, mollis, 5-8 mm longum.

Holotypus : In dedivibus supra Harwan, Kashmir, alt. 1,900 m : Gurcharan Singh No. 623. In Herbario Departmenti Phytologiai.

Universitatis Kashmiriensis, Srinagar conservatur.

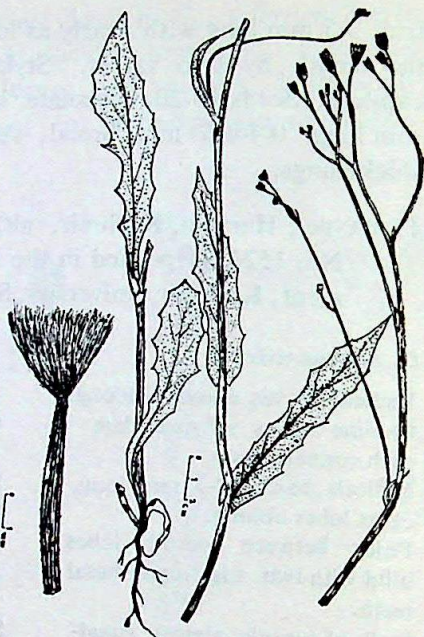


Fig. 7. *Crepis dachhigamensis* Singh

Annual herb, simple or sparsely branched. Radical leaves 2-4, oblanceolate or lanceolate, hairy, petioled, margins with few sharp teeth; cauline leaves few, lanceolate, 4-10 cm long, base with acute auricles. Heads on long almost naked branched peduncles, 10-15 mm across, ligulate. Involucre bracts 2 seriate, outer hardly 2-3 mm long, inner linear, 8-14 mm long, elongating in fruiting to often 18 mm, midrib prominent and raised, receptacle naked. Achenes narrowly cylindrical, narrowed above, rigid, 7-10 mm long. Pappus soft, white, 5-8 mm long, hairs simple. Ligules yellow.

Holotype: Slopes above Harwan, Kashmir, alt. 1,900 m: Gurcharan Singh No. 623. Deposited in the Herbarium of Botany Department, Kashmir University, Srinagar.

Crepis dachhigamensis in its annual habit, linear elongate achenes and naked branches of peduncle is closer to *C. sancta* L., but can be easily separated from this in few less cut radical leaves, presence of distinct cauline leaves, naked receptacle, stouter longer achenes and rigid longer involucre bracts.

Bromus barobalianus Gurcharan Singh sp. nov. Fig. 8

Habitu *Bromus japonicus* Thunb. sed distat: panicula flexuosus ramis pilosus, spicula compressus, majoribus, lemma carinatus, longioribus, antherae longioribus.

Annua, 15-40 cm alta, omino melliter pilosa. Folia linearis, 5-12 cm longa, 3-5 mm lata; ligula 1.5-2 mm longa, apice fisso truncata. Panicula patens; ramis 6-14, flexuosus, tenuibus pilosis, 2-5 cm longis. Spiculis pendentibus, solitariis, compressus, 15-23 mm longis (aristis exclusis), 6-12 floris, apice attenuatus. Gluma inferior 6-8 mm longa, 3-nervis,

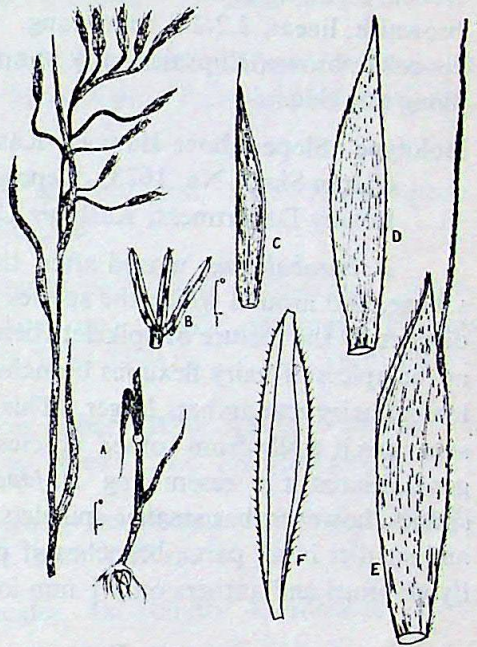


Fig. 8. *Bromus barobalianus* Singh superior 9-11 mm longa, 5-7 nervis, utrae pilosae. Lemma 11-13 mm longa, carinatus, pilosa externus, 7-9 nervis, arista subapicali, 12-18 mm longa, apice bidentata, dentibus 1-1.5 mm longis, arista fructifer recurvatis. Palea 9-10 mm longa, membranacea, pilosa externus, 2-nervis, margine incurvatus, nervis hispidus. Antherae furcescentes, 2.2-2.8 mm longae. Caryopsis 4-6 mm longa, ellipsoidea, brunnea, canaliculata, apice pilosa.

Holotypus : In dedivibus supra Harwan, Kashmir, alt. 2,300 m: Gurcharan Singh No. 1623. In Herbario Departmenti Phytologiae, Universitas Kashmiriensis, Srinagar conservatur.

Annual herb, 15-40 cm tall, softly hairy all over. Leaves linear, 5-12 cm long, 3-5 mm broad; ligule 1.5-2 mm long with truncate parted apex. Panicle spreading with 6-14 branches: branches slender, flexuous, densely softly hairy, 2-5 cm long. Spikelets drooping, 15-23 mm long excluding the awn, compressed, attenuated above, 6-12 flowered. Lower glume 6-8 mm long, 3 nerved, upper glume 9-11 mm long, 5-7 nerved, both glumes hairy without. Lemma 11-13 mm long, keeled, hairy without, 7-9 nerved, awned; awn subapical, 12-18 mm long, recurved in fruiting; apex of lemma two toothed, teeth 1-1.5 mm

long. Palea 9-10 mm long, hairy without, prominently two ribbed, membranous, margins incurved, ribs hispid. Anthers brownish, linear, 2.2-2.8 mm long. Caryopsis 4-6 mm long, chocolate brown, ellipsoid, hairy at apex, longitudinally grooved along one side.

Holotype : Slopes above Harwan, Kashmir, alt. 2,300 m: Gurcharan Singh No. 1623. Deposited in the Herbarium of Botany Department, Kashmir University, Srinagar.

B. barobalianus, named after the peak overlying Harwan village, and around which the species is quite common, is quite distinct by the feature of spikelets being compressed and solitary at the apices of hairy flexuous branches of panicle, glumes and lemma hairy and anthers larger. This combination of characters separates it easily from other species of the genus, though in general habit it is resembling *B. japonicus* Thunb. This latter species, however, has smaller spikelets, being scarcely compressed and smaller in all parts, branches of panicle and spikelets usually glabrous and anthers only 1 mm long.

ROSACEAE

Acomastylis elata (Wall.) F. Bolle in Fedde, Rep. Beih. 72, 83, 1933; Hara and Ohashi in Hara, Fl. East. Himal. 118, 1966 *Geum elatum* Wall. ex Hook. f., Fl. Brit. India 2:343 1878.

Sieversia elata Royle, Ill. Bot. Himal. 207, t. 39, 1834.

Perennial herb, common in alpine and subalpine pastures. Flowers June-September, yellow. Alt. 3000-3500 m.

Vern. GOGJI MUL

Agrimonia pilosa Ledeb., var. *nepalensis* (D. Don) Nakai. Tokyo Bot. Mag. 47:247, 1933; Gupta, Fl. Nainitalensis 120, 1968. *A. eupatorium* sensu Hook. f. l. c. 361 (non L.).

Erect perennial herb, common in forest openings and on humus rich soils. Flowers June-August, yellow. Alt. 1700-2300 m. *Alchemilla vulgaris* L., Sp. Pl. 123, 1753; Hook. f. l. c. 360.

Perennial herb, usually in moist places, along mountain drains. Flowers May-August, greenish. Alt. 2400-3100 m.

Cotoneaster racemiflora (Desf.) C. Koch., Hort. Dendrol. 1: 170, 1853; Rehder, Man. Cult. Trees and Shrubs 354, 1940.

C. nummularia Fisch. & Mey., Ind. Sem. Horti Petrop. 2:34, 1875; Hook. f.l.c. 386.

Deciduous to semievergreen dwarf spreading shrub, common on dry slopes and forest openings. Flowers April-May, white. Alt. 1700-2400 m. Vern. LENU

C. rosea Edgew. Trans. Linn. Soc. 20:46, 1851; Rehder, l.c. *C. bacillaris* var. *affinis* Hook. f., l.c. 385 (pro parte).

Deciduous shrub, usually on humus rich soils. Flowers April-May, pink. Alt. 2100-2500 m.

C. aitchinsoni C.K. Schneider, Ill. Handb. Laubholzk 1:749, 1906.

Tall semievergreen shrub, on moister slopes and in forests. Flowers April-May, white. Alt. 1700-2400 m. Vern. LENU.

Crataegus monogyna Jacq., Fl. Austr. 30:50, 1775; Ball, Flora Europaea 2:75, 1968.

C. oxycantha L., Sp. Pl. 477, 1753 (Nom. ambig.); Hook, f., l.c. 383.

Deciduous tree, common on open slopes and in forests. Flowers April-May, white. Alt. 1700-2500 m.

Vern RHING.

Duchesnea indica (Andr.) Focke in Engler and Prantl, Pflanzen. II, 3:33, 1888; Hutchinson, Gen. Fl. Plants 1:198, 1964. *Fragaria indica* Andr., Bot. Rep. t. 479, 1807; Hook. f., l.c. 343.

Perennial creeping herb, often confounded with *Potentilla reptans* L., but distinguished by its trifid bracteoles and succulent

torus, usually found in moister places. Flowers April-September, yellow. Alt. 1700-2200 m.

Geum urbanum L., Sp. Pl. 501, 1753; Hook. f., l.c. 342.

Perennial herb, often locally common in forests and on humus rich soils. Flowers April-June, yellow. Alt. 1700-2600 m.

Filipendula vestita Maxim., Acta Horti Petrop, 6:248, 1879; Hutchinson, l.c. 193.

Spiraea vestita Wall. ex Hook. f., l.c. 323.

Perennial herb, usually along mountain drains and in taller herbaceous vegetation. Flowers July-September, creamy white. Alt. 2200-2900 m.

Fragaria vesca L., Sp. Pl. 501, 1753; Hook. f., l.c. 344.

Perennial stoloniferous herb, often abundant as forest under growth and on humus rich soils. Flowers April-August, white. Alt. 1700-3100 m.

Vern. STABUR

Kerria japonica (L.) DC., Trans. Linn. Soc. London 12:157, 1818; Parker For. Fl. Punjab etc. 230, 1918.

Deciduous shrub, only a few planted individuals in the Harwan park. Flowers April-June, yellow, Alt. 1700 m.

Padus cornuta (Wall. ex Royle) Carr., in Rev. Hortic. 275. f. 64, 1869.

Cerasus cornuta Wall. ex Royle, Ill. Bot. Himal. 207, t. 38, f. 2, 1835.

Prunus cornuta (Wall. ex Royle) Steud., Nom. Bot. ed. 2, 2:403, 1841.

P. padus Brandis For. Fl. 194, 1874 (non L.); Hook. f., l. c. 315; Collett, Fl. Simlensis 156, 1921.

Deciduous tree, locally common in forests often in associ-

ation with other deciduous tree elements. Flowers April-May, white. Alt. 1800-2600 m. Vern. ZOMB, WOTIL

Prunus armeniaca L., Sp. Pl. 474, 1753; Hook. f., l. c. 313.

Deciduous tree, fairly common in the ravine, usually along roadsides. Flowers March-April, before leaves, pink. Alt. 1700-2200 m. Vern. TSER

P. cerasifera Ehrh., Beitr. Naturk. 4:17, 1789; Parker, For Fl. Punjab etc. 205, 1918.

Deciduous tree, very common in the ravine, less so on slopes. Flowers March-April, white, Alt. 1700-2100 m. Vern GURDOL

P. dulcis (Miller) D. A. Webb. Feddes Repert. 74: 24, 1917; et in Flora Europaea 2:78, 1968.

Amygdalus dulcis Miller, Gard. Dict. ed. 8, n. 2, 1768.
Prunus amygdalus Batsch.; Rehder, Man. Cult. Trees and Shrubs 463, 1940.

Deciduous tree, cultivated on outskirts, rarer in the forest. Flowers March, light pink. Alt. 1700-1800 m. No. 2210 a. Vern. BADAM

P. persica (L.) Batsch., Beyter Entw. Pragm. Gesch. Nat. Reiche 30, 1801; Hook. f., l. c. 313.

Deciduous tree, isolated individuals, rarer in the area. Flowers March-April, before leaves, pink. Alt. 1700-2300 m. Vern. TSUMAN

P. prostrata Labill, Icon. Pl. Syr. 1:15, 1791; Hook. f., l. c. 313.

Dwarf spreading deciduous shrub, on open dry slopes. Flowers April-May, purple. Alt. 1700-2300 m.

P. tomentosa Thunb., Fl. Jap. 203, 1784; Hook. f., l. c. 314.

Deciduous shrub, common in the ravine and on the slopes. Flowers March-April, pink. Alt. 1700-2400 m.

Potentilla argentea L., Sp. Pl. 497, 1753; Hook. f., l. c. 356.

Erect perennial herb, along roadsides, rarer. Flowers April-May, yellow. Alt. 1800 m.

P. argyrophylla Wall. ex Lehm: Pugillus 3:36, 1831; Hook. f., l. c. 356.

Perennial herb, common in alpine region forming tufts. Flowers July-September, yellow. Alt. 3000-4000 m.

P. atrosanguinea Lodd. ex D. Don, Prodr. Fl. Nep. 232, 1825; Ball et al., Flora Europaea 2:36, 1968.

P. argyrophylla var. *atrosanguinea* Hook. f., l. c. 357.

Perennial herb, on alpine slopes, less common. Closely allied to *P. argyrophylla* but easily distinguished by less tomentosa leaves and purple flowers. Flowers July-September, Alt. 3000-4000 m.

P. reptans L., Sp. Pl. 499, 1753; Hook. f., l. c. 356.

A creeping perennial herb, often common as forest undergrowth and near moist shaded situations. Flowers April-October, yellow. Alt. 1700-2000 m.

P. sericea L., Sp. Pl. 495, 1753; Hook. f., l. c. 354.

Erect perennial herb, usually along pathways, rarer in the area. Flowers May-June. yellow. Alt. 1700-1800 m.

Pyrus communis L., Sp. Pl. 419. 1753; Hook. f., l. c. 374.

Deciduous tree, rarer in the area, Flowers April-May, white. Alt. 1700-1900 m.
Vern. TANG

P. pashia Buch.-Ham. ex D. Don. Prodr. Fl. Nep. 236, 1825; Hook. f., l. c. 374.

Deciduous tree, rarer in the area. Flowers April-May, white. Alt. 1700-2400 m.

Rosa brunonii Lindl., Ros. Monogr. 120, t. 14, 1820.

Deciduous arching or climbing armed shrub, common in the forests and on humus rich soils. Flowers May-July, white. Alt. 1700-2400 m. Vern. KRICHI

R. brunonii Lindl., Monogr. Rosa 120, t. 14, 1820; Rehder, Man. Cult. Trees and shrubs 446. 1940; Hara and Ohashi in Hara, Fl. East. Himal. 127, 1966.

R. brunonis Wall. Cat. 689 (Nom. nud.).

R. moschata Brandis, For. Fl. 201, 1874 (pro parte); Hook. f., l. c. 367 (pro parte).

R. m. var. nepalensis Lindl. Bot. Reg. 10, t. 829, 1824.

R. moschata Hermn., Diss. Bot. Med. Rosa 15, 1762; Hook. f., l. c. (pro parte); Brandis, l. c. 201 (pro parte); Rehder, l. c. 446.

Deciduous arching or climbing armed shrub, usually along roadsides, rarer. Flowers May-July, white. Alt. 1700-1900 m. Vern. KRICH

R. macrophylla Lindl., l. c. 35, t. 6; Hook. f., l. c. 366.

Deciduous armed shrub, on open slopes and in forests, Flowers April-May, reddish. Alt. 1700-2100 m.

R. macrophylla Lindl., var. *minor* Lindl., l. c. 35; Hook. f., l. c. 366.

Deciduous armed shrub, on humus rich soils. Flowers April-May, white. Alt. 1900-2900 m.

R. webbiana Wall. ex Royle, Ill. Bot. Himal. 208, t. 42, f. 2, 1835; Hook. f., l. c. 366.

Deciduous armed shrub, common on dry open slopes, less so in forests. Flowers April-June, pink, white or reddish. Alt. 1700-2500 m. Vern. ARWAL

Rubus antennifer Hook. f., l. c. 337.

Scandent shrub with weaker branches, deciduous, common under forest shade. Flowers May-July, white. Alt. 1700-2200 m.

R. niveus Thunb., var. **pauciflorus** (Hook. f.) Saxena, Indian For. 93 (12): 798-99, 1967.

R. lasiocarpus Smith, var. *pauciflorus* Hook. f., l. c. 339, 1878.

Gregarious armed deciduous shrub, frequent in forest clearings, less frequent in forests, fruits edible. Flowers May-June pink. Alt. 1700-2300 m. Vern. CHHANCHH

R. pedunculatus D. Don, Prodr. Fl. Nep. 234, 1825; Ohashi in Hara, Fl. East. Himal. 131, 1966.

R. gracilis Roxb., Hort, Beng, 39, 1814 (nom.) ex DC. Prodr. 2: 257, 1825 (non presl, 1822).

P. niveus Wall. ex Hook. f., l. c. 335 (non Thunb. 1813).

Scandent shrub, deciduous, drier slopes, rarer. Flowers May-June, pink. Alt. 1700-2000 m.

R. pungens Camb. in Jacq., Voy. Bot. 48, t. 59, 1844; Hook. f., l. c. 341.

A weak deciduous shrub often trailing, on humus rich soils. Flowers April-May, white, Alt. 2000-2800 m.

R. ulmifolius Schott., in Oken. Isis Fasc. 5: 821, 1818; Rehder, l. c. 418; Heslop-Harrison, Flora Europaea 2: 6, 1968.

R. fruticosus var. *discolor* Hook. f., l. c. 337.

R. fruticosus auct. (non L.); Brandis, Indian Trees, 1906.

A large deciduous armed shrub, common especially in forest openings, fruits edible. Flowers May-October, pink. Alt. 1700-2300 m. Vern. CHHANCHH

Sibbaldia cuneata Hornem. Index Sem. Hort. Hafn., 1842 et ex Kuntze, in Linnaea 20: 59, 1847; Kitamura, Fl. Afghan. 183. 1960: Hara and Ohashi in Hara, Fl. East. Himal. 132, 1960.

S. parviflora Kitamura (non Willd.), Fauna and Flora Nep. Himal. 160, 1955.

Potentilla sibbaldi sensu Hook. f., l. c. 345.

Low perennial herb with branched woody root stock, common in subalpine and alpine meadows. Flowers May-September, yellow. Alt. 2000-4000 m.

Sorbaria tomentosa (Lindl.) Rehder, Journ. Arnold Arb. 19: 75, 1938; Rehder, Man. Cult. Trees and Shrubs 344, 1940; Kitamura, Fl. Afghan. 183. 1960.

Schizonotus tomentosus Lindl., Bot. Reg. 26 (Misc.): 71, 1841.

Spiraea lindleyana Wall. Cat. 703 (Nom. nud.).

S. sorbifolia Hook. f., l. c. 324 (non. L.).

Deciduous shrub, often gregarious in forest opening. Distinct from the related species, *S. aitchisoni* Hemsl. (also found in Kashmir) by doubly serrate more than 1.5 cm wide leaflets. Flowers June-July, white. Alt. 1800-2500 m.

Spiraea canescens D. Don, Prodr. Fl. Nep. 227, 1825; Hook. f., l. c. 325.

Deciduous shrub, on humus rich soils on northerly aspects. Flowers May-June, white. Alt. 1800-2400 m.

PAPILIONACEAE

Aeschynomene indica L., Sp. Pl. 713, 1753; Baker in Hook. f., Fl. Brit. India 2: 151, 1876.

Annual herb, growing along the borders of rice fields, sensitive to touch. Flowers July-September, yellow. Alt. 1700 m.

Astragalus densiflorus Kar. & Kir., Enum, Pl. Song. 254 1842; Baker in Hook. f., l. c. 125.

Perennial herb, common in alpine meadows. Flowers July-September, lilac. Alt. 2900-3800 m. No. 2201.

A. grahamianus Royle, Ill. Bot. Himal. 199, t. 36, f. 2, 1835; Kitamura, Fl. Afghan. 200, 1960.

A. polyantha Royle, l. c. 199, 1835 (non Wall.); Baker in Hook. f., l. c. 134.

Low spreading armed shrub, deciduous, on dry slopes and dry flood plains. Flowers April-May, yellow. Alt. 1700-1900 m. Vern. GAGAR KOND

Caragana brevispina Royle, l. c. 198; Baker in Hook. f., l. c. 116.

Armed deciduous shrub, rare. Flowers May-June, yellow. Alt. 1700-1800 m.

Desmodium tiliifolium G. Don, Gen Syst. 2: 297, 1832; Baker in Hook. f., l. c. 168.

Deciduous shrub, on forested slopes, less common. Flowers July-August, bluish. Alt. 1700-2200 m.

Glycine soja Sieb. & Zucc., Fam, Nat. Fl. Jap. 11; Baker in Hook. f., l. c. 184 (pro parte: excl, *Soja hispida* Moench). Annual climbing herb, in forest openings on shrubs, rarer. Flowers June-July, purple. Alt. 1700 m.

Indigofera heterantha Wall. ex Brandis, For. Fl. 135, 1874; Ali, Botaniska Notiser 3(3):566, 1958.

I. gerardiana Wall. ex Baker in Hook. f., l. c. 100.

I. gerardiana var. *heterantha* (Wall. ex Brandis) Baker in Hook. f., l. c. 100.

I. rubroviolacea Dunn, Kew Bull. 117, 1922.

Deciduous shrub, common on dry open slopes, also in forests. Flowers May-August pale greyish purple. Alt. 1700-2300 m.

Vern. KOTZ

I. himalayensis Ali, l. c. 574.

Deciduous shrub, less common though found occasionally on forested slopes and in forest openings. Very close to *I. heterantha* but distinguished by less canescent greenish leaves, glabrous ovary, darker purple corolla, calyx teeth exceeding the

cup, the standard larger and broader. Flowers May-July. Alt. 1700-2300 m.

Vern. KOTZ

L. hebeptala Benth. ex Baker in Hook. f., l. c. 101, var. *hebeptala* Ali, l. c. 572.

Deciduous shrub, usually found on humus rich soils. Flowers May-July, purple. Alt. 2000-2900 m. No. 1768.

Laythyrus aphaca L., Sp. Pl. 729, 1753; Baker in Hook. f., l. c. 179.

Annual herb, climbing by tendrils, common along roadside in the ravine. Flowers April-May, yellow. Alt. 1700-1800 m.

L. inconspicuous L. Sp. Pl. 733, 1753; Baker in Hook. f., l. c. 180.

Annual herb, along roadsides, rare. Flowers April-May, lilac or yellow. Alt. 1700-1800 m.

L. pratensis L., l. c. 733; Baker in Hook. f. l. c. 180.

Perennial herb, climbing by tendrils, rare. Flowers May-July, yellow. Alt. 1700-2200 m.

L. altaicus Ledeb., Fl. Alt. 3, 355. 1831; Baker in Hook. f., l. c. 130.

Perennial herb, common in forest shade. Flowers June-August, purple or yellow. Alt. 2000-2500 m.

L. sphaericus Retz., Obs. Bot. 3: 39, 1785; Baker in Hook. f., l. c. 180.

Annual climbing herb, growing among scrubs. Flowers May-July, purple. Alt. 1700 m. *First collection from Kashmir.*

Lespedeza cuneata G. Don, Gen. Syst. 2: 307, 1832; Kitumura, Fl. Afghan. 235, 1960; Gupta Fl. Nainitalensis 91, 1968. *L. sericea* Miq., Ann. Mus. Ludg, Bot. 3: 49, 1867 (non Benth.), Baker in Hook. f., l. c. 142.

Deciduous undershrub, branches ascending or erect, common in moist shaded places near water. Flowers July-September, bluish-purple. Alt. 1700-2300 m.

L. elegans Camb. in Jacq., Voy. Bot. 43, t. 52, 1844; Baker in Hook. f., l. c. 143.

Deciduous undershrub, ascending or suberect, locally common on dry slopes, roadsides. Flowers July-September, bluish--purple. Alt. 1700-2000.

L. gerardiana Grah. ex Baker in Hook. f., l. c. 142.

Spreading undershrub, branches trailing or ascending on dry open slopes. Flowers July-October, bluish purple. Alt. 1700-2300 m.

L. variegata Camb., in Jacq. Voy. Bot. 42, t. 5, 1844; Rao, Rec. Bot. Surv. India 18(2):25, 1960.

L. juncea Baker in Hook. f., l. c. 142.

Spreading undershrub, deciduous, branches trailing on dry scrubby slopes. Flowers July-November, bluish purple. Alt. 1700-1900 m.

Lotus corniculatus L., Sp. Pl. 775, 1753; Baker in Hook. f., l. c. 41.

Perennial ascending herb, common in grasslands, less so in forests. Flowers April-July, yellow. Alt. 1700-2500 m.

Medicago minima (L.) Barta, Cat. Plante Siene 61, 1776; Tutin, Flora Europea 2:157, 1968.

M. minima Lamk.; Baker in Hook. f., l.c. 91.

Spreading annual herb, common in grasslands, less so in forests. Flowers March-June, yellow. Alt. 1700-2300 m.

M. lupulina L., Sp. Pl. 779, 1753; Baker in Hook. f., l. c. 90.

Perennial spreading herb, common in grasslands and pastures. Flowers March-November, yellow. Alt. 1700-2300 m.

M. polymorpha L. Sp. Pl. 779, 1753; Tutin, Flora, Europaea 2:157, 1968.

M. denticulata Willd., Sp. Pl. 3:1414, 1800; Baker in Hook. f., l. c. 90.

M. hispida var. *denticulata* (Willd.) Barnet, Fl. Alps. Maritimes 2:107, 1896; Kitamura, Fl. Afghan. 236, 1960.

Annual herb, rarer in the area, found in moist shaded situations. Flowers April-July, yellow. Alt. 1700-1900 m.

Melilotus indica (L.) All., Fl. Ped. 1:308, 1785; Kitamura, Fl. Afghan. 237, 1960; Hansen, Flora Europaea 2:149, 1968.

Trifolium indicum L., Sp. Pl. 765, 1753.

Melilotus parviflora Desf., Fl. Atlant. 2:192, 1800; Baker in Hook. f., l. c. 89.

Erect annual herb, rarer in the area. Flowers May-July, yellow. Alt. 1700 m.

Robinia pseudoacacia L., Sp. Pl. 722, 1753; Rehder, Man. Cult. Trees and Shrubs 509, 1940.

Deciduous tree, abundant in the ravine having naturalised by frequent propagation by root suckers and seeds. Flowers April-May, white. Alt. 1700-2000 m.

Vern. KIKUR

Sophora japonica L., Mattissa 68, 1768, Rehder, l. c. 489.

Deciduous tree, along Harwan reservoir, planted, rare. Flowers July-August, yellow. Alt. 1700 m.

Trifolium dubium Sibth., Oxon. 231, 1794; Singh, Bull. Bot. Surv. India 12 (1-4) : 268, 1970.

T. minus Smith, Engl. Bot. Pl. 1256, 1799; Collett, Fl. Simlensis 116, 1921.

Annual spreading herb, common in less pastured grasslands. Flowers May-June, yellow. Alt. 1700-1800 m.

T. fragiferum L., Sp. Pl. 772, 1753; Baker in Hook. f., l. c. 86.

Perennial repent herb, rare, in moister shaded areas. Flowers May-November, pink. Alt. 1700 m.

T. pratense L., Sp. Pl. 768, 1753; Baker in Hook.f., l.c. 86.

Perennial ascending herb, common in Harwan park, less so in ravine. Flowers May-August, purple pink. Alt. 1700-1900 m.

T. repens L., Sp. Pl. 768, 1753; Baker in Hook.f., l. c. 86.

Perennial repent herb, common mostly in shaded moister areas. Flowers March-June, September-November, white. Alt. 1700-2300 m.

Vern. PATAK NEUR

Trigonella emodi Benth. in Royle, Ill. Bot. Himal. 197, 1835; Baker in Hook.f., l.c. 88.

Spreading perennial herb, on alpine slopes. Flowers June-August, yellow. Alt. 2800-3900 m.

Vicia hirsuta (L.) Gray, Syst. arrang. Brit. Pl. 2 : 614, 1821; Baker in Hook.f., l. c. 177.

Annual climbing herb, in waste places, rare. Flowers May-July, bluish. Alt. 1700 m.

V. sativa L., subsp. *nigra* (L.) Ehrh., Hannover Mag. 15 : 299, 1780; Ball, Flora Europaea 2 : 134, 1968.

V. sativa var. *angustifolia* Baker in Hook.f., l. c. 178.

V. angustifolia L., Amoen. Acad. 4 : 105, 1759; Gupta, Fl. Nainitalensis 106, 1968.

Annual herb, climbing by tendrils, in cultivated fields and wastelands. Flowers April-June, purple. Alt. 1700-1800 m.

Vern. SIGRI

V. sativa L., Sp. Pl. 736, 1753 subsp. *sativa* Ball, Flora Europaea 2 : 135, 1968; Baker in Hook.f., l. c. 178.

Annual herb, climbing by tendrils, in cultivated fields and wastelands. Flowers April-June, purple. Alt. 1700 m.

GROSSULARIACEAE

Ribes glaciale Wall. in Roxb., Fl. Ind. ed Carey 2 : 513, 1824; Clarke in Hook.f., Fl. Brit. India 2 : 410, 1878.

Deciduous shrub, mostly on rocky cliffs. Flowers April-May, pink. Alt. 2000-2500 m.

ARALIACEAE

Aralia cashemirica Decne., in Jacq. Voy. Bot. 72, t. 81, 1840; Clarke in Hook.f., l. c. 722.

Deciduous shrub, usually in forests. Flowers August-October, white. Alt. 1700-2200.

Hedera nepalensis C. Koch, in Hort. Dendr. 284, 1853: Rehder, Man. Cult. Trees and Shrubs 673, 1940; Gupta, Fl. Nainitalensis 156, 1968.

H. helix Clarke in Hook.f., l. c. 739 (non L.).

H. himalaica Tobler, Gatt. Hedera 67, f. 31-36, 1912.

Evergreen woody climber, common in forests climbing on trees and rocky cliffs. Flowers October-December, creamy. Alt. 1700-2600 m.

Vern. PAL WALNU

Identified with *H. helix* L. in "Flora of British India", the Himalayan plant is distinct from the European *H. helix* L. in scaly pubescence, leaves of fertile branches cuneate at base and yellow or red fruits. *H. helix* L. has hairy pubescens, leaves of fertile branches rounded or truncate at base and black fruits.

CAPRIFOLIACEAE

Lonicera discolor Lindl. Bot. Reg. 30 : 33, 1844; Rehder. Man. Cult. Trees and Shrubs 865, 1940; Kitamura, Fl. Afghan. 370, 1960.

L. orientalis var. *discolor* (Lindl.) Clarke in Hook.f., l. c. 15.

Deciduous shrub, on scrubby slopes, less common. Flowers May-June, white tinged red. Alt. 1800-2300 m.

L. quinquelocularis Hardw., Asiat. Res. Soc. Beng. 6 : 351, 1799; Clarke in Hook.f., l. c. 14.

Deciduous shrub, common in ravine and on slopes along

with other woody vegetation. Flowers April-June, yellow. Alt. 1700-2300 m.

Sambucus wightiana Wall. ex Wight & Arnott, Prodr. 388. 1834; Singh, Indian For. 99(4) : 235, 1973.

S. ebulus Clarke in Hook.f., l. c. 2 (non L.); Parker, For. Fl. Punjab etc. 275, 1918.

S. gautschii Wettst., in Oest. Bot. Zoitschr. 40 : 230, t. 2, 1890.

Tall herbaceous perennial, often forming pure stands along mountain pathways. Flowers June-August, creamy white. Alt. 2200-3000 m.

Vern. PHOK LOND

Viburnum grandiflorum Wall. ex DC., Prodr. 4 : 329, 1830; Rehder, Man. Cult. Trees and Shrubs 832, 1940.

V. nervosum Hook.f. & Thoms., Journ. Linn. Soc. 2 : 178, 1858; Clarke in Hook.f., l. c. 8.

V. foetens Decne. in Jacq. Voy. Bot. 75, t. 84, 1844; Clarke in Hook.f., l. c. 8.

Deciduous shrub, common in forests and moister slopes. Flowers February-April, with altitude, pinkish white. Alt. 1700-3000.

Vern. KULMANCH, KULEM

V. cotinifolium Don, Prodr. Fl. Nep. 141, 1825; Clarke in Hook.f.

Deciduous shrub, common in forests and on scrubby slopes, Flowers April-May, white or tinged purple. Alt. 1700-2400 m.

PLATANACEAE

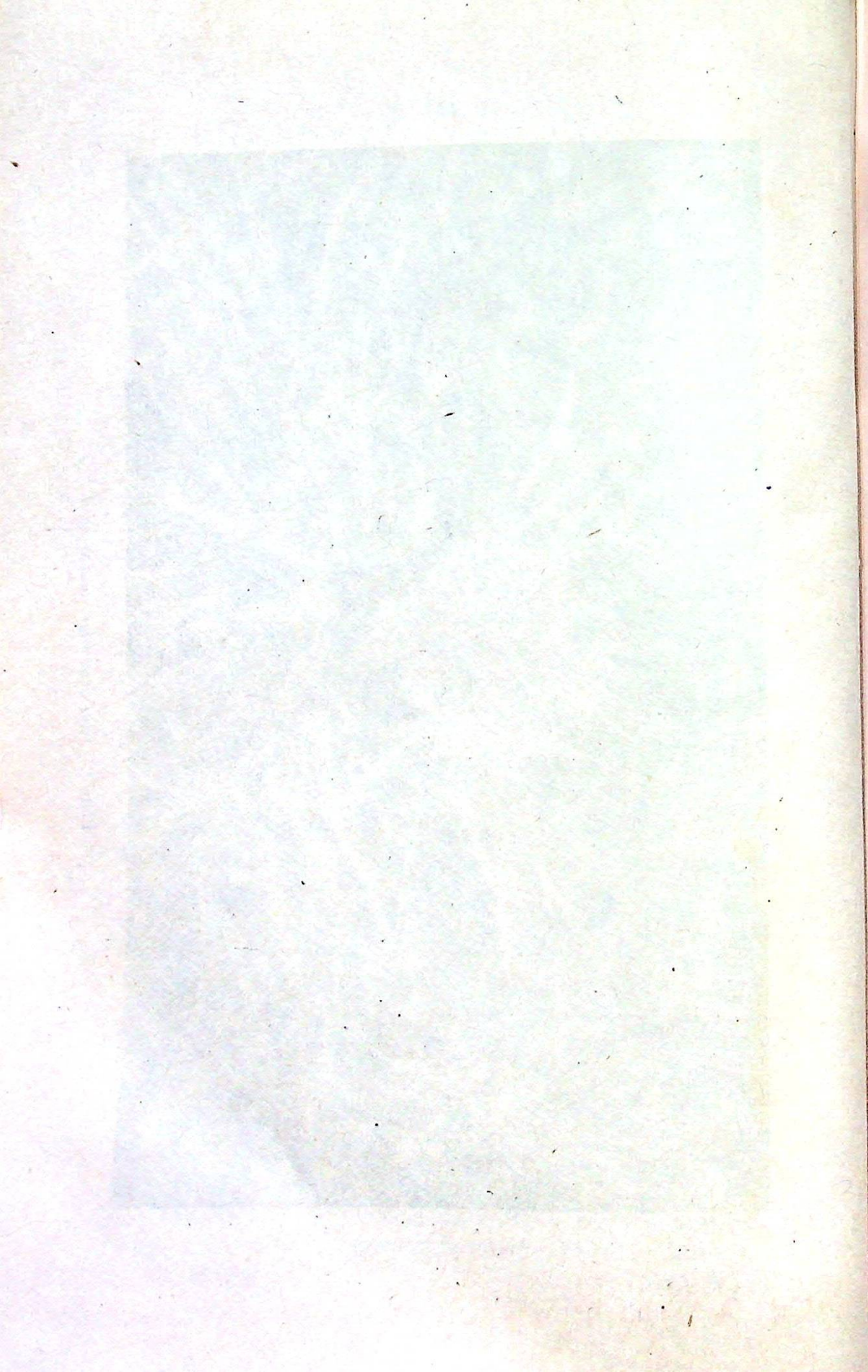
Platanus orientalis L., Sp. Pl. 998, 1753; Hook. f., Fl. Brit. India 5:594, 1888.

Deciduous tree attaining considerable height and spread, planted on outskirts, remnants in ravine. Flowers April-May, greenish-brown.

Vern. BOIN



Plate 7. *Sambucus wightiana* Wall.



HAMAMELIDACEAE

Parrotiopsis jacquemontiana (Decne.) Rehder, in Journ. Arnold Arb. 1:256, 1920; Hutchinson, Gen. Fl. Plants 2:101, 1967. *Parrotia jacquemontiana* Decne., in Jacq., Voy. Bot. 4:73, t. 82, 1840.

Deciduous gregarious shrub, abundant on northerly slopes often forming large pure stands. Flowers April-May, creamy white. Alt. 1700-2500 m.

Vern. POH, HATAB

SALICEAE

Populus alba L., Sp. Pl. 1034, 1753; Hook. f., Fl. Brit. India 5: 639, 1888.

Deciduous tree, locally common in ravine at few places, in damp situations. Flowers April, Alt. 1700-2100 m.

Vern FRAS

P. ciliata Wall. ex Royle, Ill. Bot. Himal. 346, t. 98, 1839; Hook. f., Fl. Brit. India 5:638, 1888.

Deciduous tree, along mountain streams. Flowers March-April, Alt. 1700-2200 m.

P. laurifolia Ledeb., Fl. Alt. 4:297, 1833; CSIR, Wilh. India 8: 214, 1969; Rehder, Man. Cult. Trees and Shrubs 78, 1940.

P. balsamifera Hook. f., l. c. 638 (pro parte).

Deciduous tree with spreading branches, planted along paths. Flowers April, greenish. Alt. 1700-1800 m.

Vern FRAS

P. nigra L., var. *italica* (Munchh) Koehne, Deut. Dendr. 81, 1893; Kitamura, Fl. Afghan. 80, 1960; Franco, Flora Europea 1:55, 1964.

P. nigra Brandis, Indian Trees 640, 1906.

P. pyramidalis Roizer, Cours d'Agric. 7:619, 1786.

Deciduous pyramidal tree reaching considerable height, planted along pathways. Flowers April, greenish. Alt. 1700-1900 m. Vern. FRAS

Salix alba L., Sp. Pl. 1021, 1753; Hook. f. Fl. Brit. India 5:629, 1888.

Deciduous tree, common in ravine, planted along roadsides and along streams. Flowers March, catkins greenish yellow. Alt. 1700-1900 m. Vern. BOT VIR

S. babylonica L., Sp. Pl. 1017, 1753; Hook. f., l. c. 629.

Deciduous tree, distribution of *L. alba*. Flowers March, greenish. Alt. 1700-1900 m. Vern. KOSHAR VIR

S. acmophylla Boiss., Diagn. Pl. Or. Ser. 1, 7:98, 1846; Hook. f., l. c. 628.

Deciduous tree, planted, rare in area. Flowers March-April, greenish yellow. Alt. 1700 m. Vern. VIR

S. aegyptica L., Cent. Pl. 1:33, 1755; Skvortsov, Fl. Iranica 63:31, 1969.

Deciduous tree, planted, isolated in ravine. Flowers February-March, yellowish green, Alt. 1700 m.

Vern. BRED MUSHK

S. wallichiana Andrs., in Svensk. Akad. Handb. 1850:477, 1851; Hook. f., l. c. 628.

Deciduous tree, common on forested slopes and in ravine. Flowers March-April, catkins brownish black, before leaves. Alt. 1700-2600 m.

Vern. GEUR

BETULACEAE

Alnus nitida Endl., in Gen. Suppl. 4:2, 1847; Hook. f., l. c. 600.

Tall deciduous tree, few planted trees near New Thid village. Flowers July-August, greenish. Alt. 1700 m.

Vern. CHAMP KUL

Betula utilis D. Don. Prod. Fl. Nep. 58, 1825; Hook. f., l. c. 599.

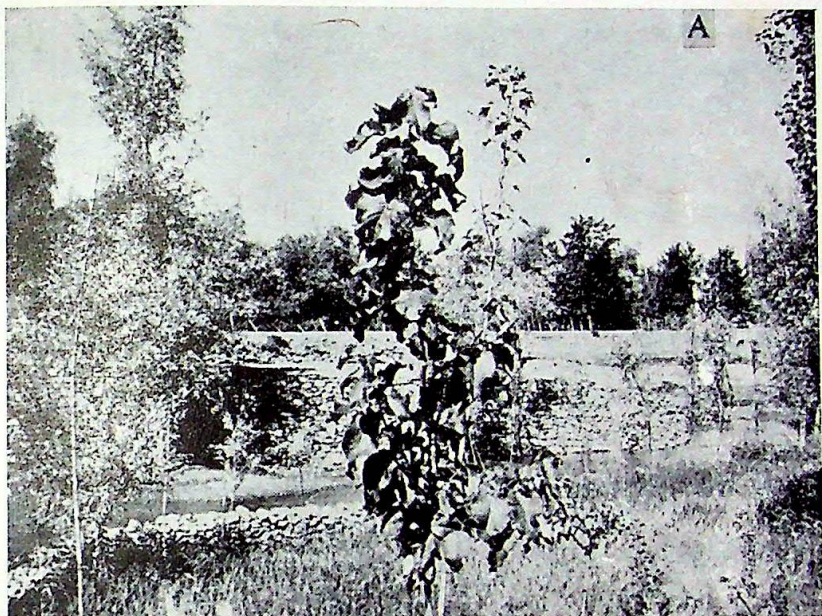
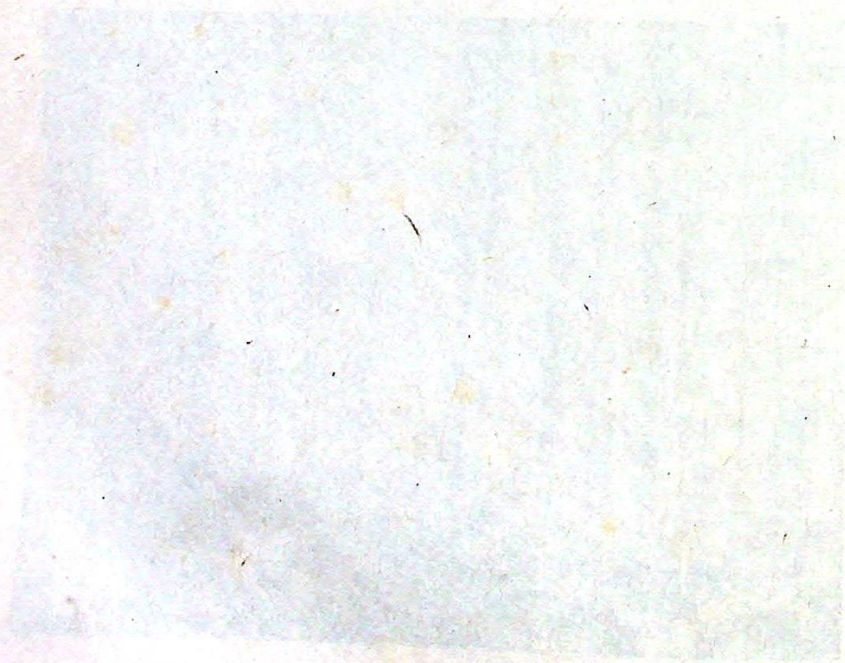
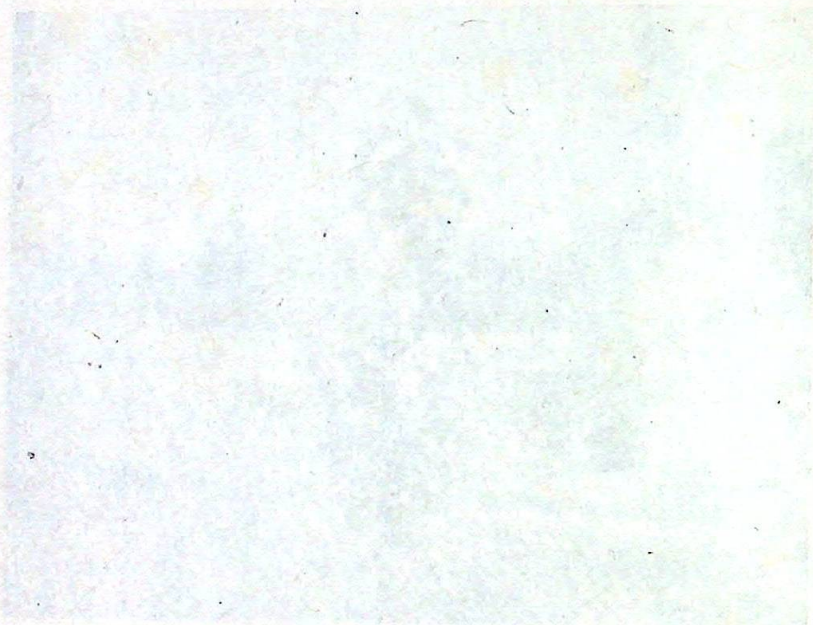


Plate 8. A. *Populus ciliata* Wal'.

B. *P. italica* L. var. *nigra* (Munchh) Koehn:z, leafless in autumn.



Deciduous tree, forming pure stands at upper limits, mixed with coniferous elements below. Flowers May-June, greenish brown. Alt. 3000-3500 m. Vern. BURZ

FA GACEAE

Castanea sativa Mill., Gard. Dict. ed. B. n. l. 1768; Brandis, Indian Trees 636, 1921.

Deciduous tree, planted on outskirts near villages. Flowers April-May, greenish. 1700 m. Vern. PUNJEB GOR

Quercus rober L., Sp. Pl. 996, 1753; Rehder, Man. Cult. Trees and Shrub 167, 1940.

Deciduous tree, planted and locality naturalised in ravine. Flowers April, greenish yellow. Alt. 1700-1800 m.

Vern. HUM

CORYLUS

Corylus colurna L., Sp. Pl. 999, 1753; Hook. f., Fl. Brit. India 5:625, 1888.

Deciduous tree, often forming stands in association with *Ulmus wallichiana* Subsp. *xanthoderma* isolated individuals in coniferous forests. Flowers March-April, Alt. 2200-2800 m.

Vern. VIRNI

JUGLANDACEAE

Juglans regia L., Sp. Pl. 997, 1753; Hook. f., Fl. Brit. India 5:595, 1888.

Deciduous tree, planted and naturalised. Flowers March-April, greenish. Alt. 1700-2100 m. Vern. DOON

ULMACEAE

Celtis caucasica Willd., Sp. Pl. 4, 2:994, 1806; Kitamura, Fl. Afghan. 84, 1960.

C. australis sensu Hook. f., Fl., Brit. India 5:482, 1888 (non L.).

Deciduous tree, fairly common in ravine and on slopes.

Flowers March, yellowish green. Alt. 1700-2600 m.

Vern. BRIMIJ

Ulmus villosa Brandis ex Gamble, Man. Indian Timbers ed. 2 : 628, 1902; Melville & Heybroek, Kew Bull. 26(1):21, 1971.

U. laevigata Royle, Ill. Bot. Himal. 341, 1839 (Nom. nud.); Parker, For. Fl. Punjab etc. 465, 1918.

Deciduous tree attaining considerable height, common locally in ravine. Flowers February-March, chocolate brown. Alt. 1700-1800 m.

Vern. BREN

U. wallichiana Planch., in Ann. Sc. Nat. Ser. 3, 10 : 277, 1848; subsp. *xanthoderma* Melville & Heybroek, Kew Bull. 26(1) : 10, 1971.

Deciduous tree, well distributed in deciduous forests often in association with *Corylus colurna*. Flowers March, greenish. Alt. 1700-2800 m.

Vern. BRARI

CANNABIACEAE

Cannabis sativa L., Sp. Pl. 1027, 1753; Hook.f., Fl. Brit. India 5 : 487, 1888; Tutin. Flora Europaea 1 : 67, 1964.

Erect annual herb, in neglected areas, sometimes along cultivated fields. Flowers July-September, yellowish green. Alt. 1700-1800 m.

Vern. BHANG

MORACEAE

Morus alba L., Sp. Pl. 986, 1753; Hook.f., Fl. Brit. India 5:492, 1888; Rehder, Man. Cult. Trees and shrubs 188, 1940.

Deciduous tree, naturalised and fairly common in ravine, less so on slopes. Flowers March-April, greenish yellow. Alt. 1700-2500 m.

Vern. TUL

M. nigra L., Sp. Pl. 986, 1753; Brandis Indian Trees 612, 1921.

Deciduous tree, usually cultivated, a few escapes in ravine. Flowers April-May, greenish. Alt. 1700 m.

Vern. SHAH TUL

URTICACEAE

Parietaria debilis Forst. f. Fl. Inst. Austral. Prodr. 73, 1786; Hook.f., Fl. Brit. India 5 : 593, 1888.

Annual herb, usually locally common under rocks. Flowers August-September, green. Alt. 2500-3000 m. New record for Kashmir.

Urtica dioica L., Sp. Pl. 984, 1753; Hook.f., l.c. 548.

Perennial stinging herb, common in abandoned areas. Flowers July-November, greenish. Alt. 1700-2400 m.

Vern. SOI

U. parviflora Roxb. Fl. Indio 3 : 581; Hook.f., l. c. 548.

Perennial herb, usually in forests and among taller herbaceous vegetation. Flowers August-November, greenish. Alt. 1700-2800 m.

Vern. SOI

THYMELAEACEAE

Daphne oleoides Schreb., Icon. Descr. Pl. 13, 1766; Hook.f., Fl. Brit. India 5 : 193, 1886.

Evergreen shrub, on dry open slopes. Flowers April-May, white. Alt. 1700-2300 m.

Vern. GANDH LENU, VETHRU

VIOLACEAE

Viola biflora L., Sp. Pl. 936, 1753; Hook.f. & Thoms., Fl. Brit. India 1 : 182, 1872.

Perennial herb with rosette leaves, in moister areas in the alpine region. Flowers June-August, yellow. Alt. 3000-3700 m.

V. falconeri Hook. f. & Thoms., l. c. 185.

Perennial herb with rosette leaves, on humus rich soils in forests. Flowers April-May, pinkish. Alt. 1800-2600 m.

V. odorata L., Sp. Pl. 936, 1753; Hook.f. & Thoms., l.c. 184.

Perennial herb with rosette leaves, locally common in forests. Flowers March-April, bluish. Alt. 1700-1900 m.

Vern. BANAFSH

V. patrinii DC., Prodr. 1 : 293, 1824; Hook.f. & Thoms., l.c. 183.

Perennial herb, usually under forests shade. Flowers March-April, lilac. Alt. 1900-2700 m.

V. serpens Wall. ex Roxb., Fl. Ind. ed. Wall. 2:449, 1824; Hook. f., and Thoms, l. c, 184.

Perennial herb, under forest shade. Flowers April-May, bluish. Alt. 1800-2300 m.

V. sylvatica Frier ex Hartim, in Bot. Notiser, 81, 1841; Blatter, Beaut. Fls. Kash. 1:46, 1927.

V. canina var. *sylvatica* (Fries) Hook. f. and Thoms., l. c. 185.

Perennial herb with rosette leaves, common in between boulders and near tree trunks. Flowers March-April, bluish. Alt. 1700-2200 m.

POLYGALACEAE

Polygala sibirica L. ssp. *monopetala* (Camb.) Chodat in Mem. Soc. Phys. Hist. Nat. Genev. 31, 2:348, 1893.

Perennial herb, in dry rocky areas, rarer. Flowers April-May, purplish. Alt. 1700-1900 m.

MALVACEA

Althaea rosea (L.) Cav., Diss. 2:91, t. 29, f. 3, 1786; Bailey, Man. Cult. Plants 658, 1949.

Biennial herb, an escape from cultivation, rare. Flowers July-September, bluish pink. Alt. 1700 m.

Hibiscus trionum L., Sp. Pl. 697, 1753; Masters in Hook.f., Fl. Brit. India 1 : 334, 1874.

Annual herb, usually in moist places along rice fields. Flowers July-November, yellowish. Alt. 1700-1800 m.

Lavatera cashemiriana Camb., in Jacq., Voy. Bot. 4 : 29, 1840; Masters, l.c. 319.

Perennial herb, on humus rich soils. Flowers June-August, bluish pink. Alt. 1700-2800 m,

Malva neglecta Wallr., in Syll. Ratisb. 1 : 140, 1824; Kitamura, Fl. Afghan. 271, 1960.

M. rotundifolia auct. (non L.); Master, l.c. 320.

Biennial herb, usually along roadsides and in wastelands. Flowers May-July, October-December, white. Alt. 1700-2000 m.
Vern. SOTSUL

EUPHORBIACEAE

Euphorbia helioscopia L., Sp. Pl. 456, 1753; Hook.f., Fl. Brit. India 5 : 262, 1887.

Annual herb, common in pastured areas. Flowers April-June, greenish cyathium. Alt. 1700-1900 m.

Vern. GUR SOTSUL

E. hispida Boiss., Cent. Euphorb. 8, 1860; Hook.f., l.c. 265.

Annual spreading herb, common along roadsides, also on dry open slopes. Flowers June-November, cyathia purplish or green with white margins. Alt. 1700-1900 m.

E. indica Lam., Encycl. Bot. 2 : 423, 1786; Kitamura Fl. Afghan. 259, 1960.

E. hypersifolia sensu Hook.f., l.c. 249 (non L.).

Spreading annual herb, on dry slopes, very rare. Flowers August-September, cyathia greenish tinged pinkish. Alt. 1700 m.

E. pilosa L., Sp. Pl. 460, 1753; Hook.f., l.c. 260.

Erect perennial herb, common on dry slopes, also on

humus rich soils though less common. Flowers April-June, cyathia greenish yellow. Alt. 1700-2400 m.

E. prolifera Buch.-Ham. ex D. Don, Prodr., Fl. Nep. 62, 1825; Hook.f., l. c. 264.

Erect perennial herb, usually along roadsides, wastelands, not common. Flowers April-August, cyathia greenish yellow. Alt. 1700-1900 m.

ERICACEAE

Gaultheria trichophylla Royle, Ill. Bot. Himal. 210, t. 63, f. 3, 1835; Hook.f., Fl. Brit. India 3 : 457, 1882.

Creeping shrub, in alpine pastures. Flowers June-July, Alt. 3100-3700 m.

Rhododendron campanulatum D. Don, Mem. Vern. Soc. 3 : 410, 1821; Hook.f., l.c. 466.

Evergreen shrub, often along with *Betula*. Flowers June-July, purple. Alt. 3100-3400 m.

R. anthopogon D. Don, Mem. Vern. Soc. 3 : 409, 1821; Hook.f., l.c. 472.

Dwarf evergreen shrub, forming patches in association with *Juniperus recurva*. Flowers June-August, yellow. Alt. 3300-3800 m.

HYPERICACEAE

Hypericum perforatum L., Sp. Pl. 785, 1753; Dyer in Hook.f., Fl. Brit. India 1 : 255, 1874.

Perennial herb, common on dry slopes. Flowers April-June, yellow. Alt. 1700-2300 m.

CELASTRACEAE

Euonymus fimbriatus Wall. in Roxb., Fl. Ind. ed. Carey 2 : 408, 1824; Lawson in Hook.f., Fl. Brit. India 1 : 611, 1875; Rehder, Man. Cult. Trees and Shrubs 555, 1940.

E. lacerus Buch.-Ham. in Don, Prodr. Fl. Nep. 191, 1825; Brandis, Indian Trees 158, 1921.



Plate 9. A. *Hedera nepalensis* C. Koch covering the trunk of
Robinia pseudoacacia.
 B. *Euphorbia prolifera* Buch.-Ham.

Deciduous tree, common on scrubby slopes, less so in forests. Flowers April-May, white. Alt. 1700-2100 m.

Vern. TRAN

E. hamiltonianus Wall. in Roxb., Fl. Ind. ed. Carey 2 : 403, 1824; Lawson in Hook.f., l. c. 612.

Deciduous shrub or small tree, in forests and openings, less common. Flowers May-June, creamy white. Alt. 1700-2600 m.

ELAEAGNACEAE

Elaeagnus umbellata Thunb., var. *parvifolia* (Royle) Schneider, Ill. Handb. Loubh. 2 : 411, f. 280, d-e, 1909; Rehder, Man. Cult. Trees and Shrubs 664, 1940; Gupta, Fl. Nainitalensis 305, 1968.

S. parvifolia Wall. ex Royle, Ill. Bot. Himal. 323, t. 81, f. 1, 1836.

E. umbellata sensu Hook.f., Fl. Brit. India 5 : 201, 1887 (non Thunb.).

Deciduous silvery shrub, common in ravine. Flowers May-June, white. Alt. 1700-2200 m.

LORANTHACEAE

Viscum album L., Sp. Pl. 1023, 1753; Hook.f., Fl. Brit. India 5 : 223, 1886.

Semiparasitic undershrub, on *Juglans regia* and *Aesculus indica*. Alt. 1800 m.

RHAMNACEAE

Zizyphus jujuba Mill. Gerd. Dict. ed. 8, 1768; Rehder, Man. Cult. Trees and Shrubs 596, 1940; Kitamura, Fl. Afghan. 267, 1960.

Z. vulgaris Lamk., Tabl. Encycl. 3, 2 : 330, 1793; Lawson in Hook.f., Fl. Brit. India 1 : 633, 1875.

Deciduous thorny shrub or small tree. Flowers May-June, white tinged green. On dry slopes and forest openings. Alt. 1700-1900 m.

VITACEAE

Vitis vinifera L., Sp. Pl. 293, 1753; Lawson in Hook.f., Fl. Brit. India 1 : 652, 1875.

Deciduous woody climber, usually along roadsides in the ravine. Flowers April-May, greenish white. Alt. 1700-1800 m.
Vern. DACHH

SIMAROUBACEAE

Ailanthus altissima (Mill.) Swingle, Journ. Washington Acad. Sci. 6 : 490, 1916; Raizada, Indian For. 84 (8) : 470, 1958; Tutin, Flora Europaea 2 : 230, 1968.

A. glandulosa Desf., in Mem. Acad. Sc. 265, t. 8, 1786; Bennett in Hook.f., Fl. Brit. India 1 : 518, 1875.

Deciduous tree, planted and naturalised. Flowers May-June, yellowish white. Alt. 1700-1800 m.

MELIACEAE

Melia azedarach L., Sp. 384, 1753; Hiern. in Hook.f., Fl. Brit. India 1 : 544, 1875.

Deciduous tree, planted, rare. Flowers April-May, bluish pink. Alt. 1700 m.

Vern. DREK

ANACARDIACEAE

Rhus succedanea L., Mant. 2 : 221, 1771; Hook.f., Fl. Brit. India 2 : 12, 1876.

Deciduous tree, common in ravine, less so on slopes. Fresh juice from cut twigs causes blisters. Flowers May-June, yellowish white. Alt. 1700-2300 m.

Vern. ARKHOL

ACERACEAE

Acer cappadocicum Gled. in Schrift. Ges. Naturf. For. Berlin 6 : 116, t. 2, 1785 var. *indicum* Rehder in Sargent, Pl. Wilson 1 : 76, 1911; Kitamura, Fl. Afghan. 265, 1960.

A. pictum Hiern, in Hook.f., Fl. Brit. India 1 : 696, 1875.

Deciduous tree, isolated trees in forests, rare. Flowers April-May. Alt. 1700-2400 m.

A. caesium Wall. ex Brandis, For. Fl. III. t. 21, 1874; Hiern in Hook.f., l.c. 695.

Deciduous tree, isolated trees in coniferous forests. Flowers April-May, yellow. Alt. 2400-2800 m.

HIPPOCASTANACEAE

Aesculus indica Coleb. ex Cambess in Jacq., Voy. Bot. 31, t. 35, 1844; Hiern. in Hook.f., Fl. Brit. India 1 : 675, 1875.

Deciduous tree, planted and naturalised. Flowers May-June, white. Alt. 1700-2400 m.

Vern. HAN DUN

STAPHYLEACEA

Staphylea emodi Wall. ex Brandis. For. Fl. 93, 1874; Hiern in Hook.f., Fl. Brit. India 1:698, 1875.

Deciduous shrub or small tree, locally common in forests and humus rich soils. Flowers April-May, white. Alt. 1800-2600 m.

Vern. CHHAL CHHATAR

EOLEACEAE

Fraxinus hookeri Wenzig, Engl. Bot. Jahrb. 4:179, 1883; Rehder, Man. Cult. Trees and shrubs 773, 1940.

F. exselsoir Hook.f., Fl. Brit. India 3:606, 1882.

Deciduous tree, isolated in forests. Flowers March-April. Alt. 1700-2600 m.

Vern. HGOM

Jasminum humile L., Sp. Pl. 7, 1753; Clarke in Hook.f., Fl. Brit. India 3:602, 1882.

Deciduous shrub, common on scrubby slopes and in forests. Flowers April-June, yellow. Alt. 1700-2300 m.

J. officinale L., Sp. Pl. 7, 1753; Clarke in Hook.f., l. c. 603.

Deciduous semiclimbing shrub, usually on humus rich slopes and in forests. Flowers May-August, white. Alt. 1700-2600 m.

Syringa emodi Wall. ex G. Don, Gen. Hist. Dich. Pl. 4:51, 1838; Clarke in Hook.f., l. c. 605.

Deciduous shrub, usually associated with *Rhododendron campanulatum*. Flowers May-June, white. Alt. 3000-3000 m.

S. persica lanciniata (Mill.) West.; Rehder, Man. Cult. Trees and Shrubs 782, 1940.

Deciduous shrub, planted on outskirts. Flowers April-May, lilac. Alt. 1700 m.

S. vulgaris L., Sp. Pl. 9, 1753; Rehder, Man. Cult. Trees and Shrubs 781, 1940.

Deciduous shrub, planted on outskirts. Flowers April-May, lilac. Alt. 1700 m.

APOCYNACEAE

Vinca major L., Sp. Pl. 209, 1753; Butcher, New Ill. Brit. Fl. 2:150, 1961.

Evergreen trailing semiwoody vine, in Harwan park. Flowers April-June, November-December, lilac. Alt. 1700 m.

ASCLEPIADACEAE

Cynanchum arnottianum Wight, Contrib. 58, 1834; Hook.f., Fl. Brit. India 4:22, 1883.

Perennial herb, on open humus rich soils. Flowers May-July, purplish. Alt. 1700-2500 m.

C. jacquemontii Decne in Jacq. Voy. Bot. 106, t. 112, 1840; Kitamura, Fl. Afghan. 308, 1960.

C. jacquemontianum Decne.; Hook.f., l. c. 26.

More or less a trailing perennial herb, on open dry slopes, rare. Flowers April-May, yellowish white. Alt. 1800-2300 m.

Vincetoxicum hirundinaria Medicus, in Hist. Comm. Acad. Elect. Theo Palat (Mannheim) Phys. 6:404, 1790; Markgraph ex Heywood, Bot. Journ. Linn. Soc. 64(4):374, 1971.

Cynanchum vincetoxicum Pers., Syn. Pl. 1:274, 1805; Hook.f., l. 22.

Perennial herb on open humus rich soils. Flowers May-July, yellowish. Alt. 1900-2700 m.

RUBIACEAE

Asperula cynanchica L., Sp. Pl. 104, 1753; Hook.f., Fl. Brit. India 3:209, 1881.

Perennial herb, in crevices of rocky cliffs, rarer. Flowers April-May, pink. Alt. 1900-2600 m.

Galium aparine L., Sp. Pl. 108, 1753; Hook.f., l. c. 205.

Annual herb, climbing by support and by scabrid hairs, usual among scrubs. Flowers April-June, white. Alt. 1700-1900 m.

G. asperuloides Edgew., in Trans. Linn. Soc. 20:61, 1846; Gupta Fl. Nainitalensis 168, 1968.

G. triflorum Hook.f., Fl. Brit. India 3:205, 1881 (non Michx.).

Perennial herb, usually in forests, locally common. Flowers May-July, yellowish white. Alt. 2200-2800 m.

G. serpylloides Royle ex Hook.f., Fl. Brit. India 3:207, 1881.

Perennial herb, in forest shade, rarer in our area. Flowers June-July, white. Alt. 2200-2400 m.

G. parsiense L., ssp. (Huds.) Clapham, Fl. Brit. Isles. 785, 1962; Singh, Curr. Sci. 42(23):834, 1973.

G. anglicum Huds., Fl. Angl. ed. 2:69, 1778.

G. parisiense var. *leiocarpum* Tausch, Bot. Zeit. 18:354, 1860; Boiss., Fl. Or. 3:72, 1875.

G. parisiense Butcher, New Ill. Brit. Fl. 2:408, 1961 (non L.).

Annual herb, common on dry open slopes and in cultivated fields. Flowers May-June, purplish. Alt. 1700-1900 m. Easily distinguished from *G. tenuissimum* Bieb. by its more slender habit and smaller purplish corolla.

G. gilanicum Stapf, in Denkschr. Acad. Wein. 1:53, 1885; Rechinger, Fl. Lowland Iraq 367, 1964.

G. parisiense L., var. *brachypodium* Boiss. Fl. Orient, 3:72, 1875.

Annual herb, usually below scrubs on dry slopes, and as weed of cultivation. Flowers April-May, yellowish white. Alt. 1700-1900 m. *New records for India.*

G. tenuissimum M. Bieb., Fl. Taur. Cauc. 1:104, 1808; Hook.f., Fl. Brit. India 3:308, 1881.

Annual herb, on open slopes and in cultivated fields, less common. Flowers April-May, whitish. Alt. 1700-1900 m.

G. tricornis With. Bot. Arr. Brit. Pl. ed. 2. 1:153, 1787; Hook.f., l. c. 208, 1881.

Annual herb, trailing or ascending by support, among scrubs and in cultivated fields. Flowers April-June, white. Alt. 1700 m.

G. verum L., Sp. Pl. 107, 1753; Hook.f., l. c. 208.

Perennial herb, common in open savana and scrubby slopes. Flowers April-June, yellow. Alt. 1700-2400 m.

Rubia cordifolia L., Syst. ed. 12:229, 1768 var. *cordifolia* : Dek & Malik, Bull. Bot. Surv. India 10(1):8, 1968.

Perennial herb, climbing by scabrid hairs, among scrubs. Flowers July-September, whitish. Alt. 1700-1800 m.

VERBENACEAE

Verbena officinalis L., Sp. Pl. 29, 1753; Clarke in Hook.f., Fl. Brit. India 4:565, 1885.

Perennial herb, usually in grasslands and in cultivated fields. Flowers June-October, pinkish. Alt. 1700-2300 m.

HELLEBORACEAE

Aconitum heterophyllum Wall. ex Royle, Ill. Bot. Himal. 56, t. 13, 1833; Sprague, Kew Bull. 364, 1933; Conventry, Wild. Fls. Kash. 3:23, pl. 12, 1930.

Perennial herb, usually on humus rich soils and in forests. Flowers June-August, greyish blue. Alt. 2300-2900 m.

Actaea spicata L., Sp. Pl. 504, 1753; Hook.f. & Thoms., Fl. Brit. India 1:29, 1872.

Perennial herb, in forests and among scrubs, less common. Flowers May-June, white. Alt. 2800-3300 m.

Aquilegia fragrans Benth. Maud. Bot. 4, t. 181, 1840; Mukerjee, Bull. Bot. Surv. India 2(3-4):296, 1960.
A. vulgaris subsp. *pyreniaca* (DC.) Hook.f. & Thoms., l.c. 24.

Perennial herb, growing among scrubs. Flowers May-June, white, fragrant. Alt. 2000-3500 m.

A. nivalis Falc. ex Baker, Gdnrs. Chr. 2(10):76, 1878; Mukerjee, Bull. Bot. Surv. India 2(3-4):296, 1960.
A. vulgaris subsp. *jucunda* Hook.f. & Thoms., l.c. (non Fisch. & Mey.).

Perennial herb, on alpine slopes. Flowers June-August, purple. Alt. 3800-4000 m.

A. pubiflora Wall. ex Royle, Ill. Bot. Himal. 55, 1839; Mizushima in Kitamura, Fl. Afghan. 121, 1960.
A. vulgaris subsp. *pubiflora* (Wall. ex Royle) Hook.f. & Thoms., l.c. 24.

Erect perennial herb, usually on humus rich soils. Flowers May-June, bluish purple. Alt. 2000-2700 m.

Caltha palustris L., var. *alba* (Jacq. ex Camb.) Hook.f. & Thoms., l.c. 21; Mukerjee, Bull. Bot. Surv. India 1(1-2):105, 1959.

Perennial herb, usually along mountain drains. Flowers May-August, white. Alt. 2000-3000 m.

Cimicifuga foetida L., Syst. ed. 12:659, 1768: Hook. f. & Thoms., 1 c. 30.

Tall perennial foetid herb, on open humus rich soils and among scrubs. Flowers May-July, yellowish white. Alt. 2100-3200 m.

Delphinium cashmirianum Royle, Ill. Bot. Himal. 55, t. 12, 1833; Sprague, Kew Bull. 385, 1933; Hook. f. & Thoms., 1 c. 26.

Perennial herb, on open alpine slopes. Flowers, July-September, bluish purple. Alt. 3300-4000 m.

D. denudatum Wall. ex Hook. f. & Thoms., Fl. Brit. India 1:25, 1872.

Tall perennial herb, on dry scrubby slopes and forest openings. Flowers May-July, light blue. Alt. 1700-2300 m.

D. incanum Royle, Ill. Bot. Himal. 55, 1839; Hook. f., & Thoms., 1 c. 25; Coventry, Wild Fls. Kash. 2:11, pl. 6, 1927.

Perennial herb, common in forests and humus rich scrubby slopes. Flowers July-August, blue. Alt. 1700-2400 m.

RANUNCULACEAE

Adonis aestivalis L., Sp. Pl. ed. 2, 771, 1762; Hook. f. & Thoms., Fl. Brit. India 1:15, 1872.

Annual herb, in cultivated fields, rarely in wastelands. Flowers April-May, purplish. Alt. 1700-1800 m.

Anemone falconeri Thoms. in Hook., Ic. Pl. t. 899, 1852; Hook. f. & Thoms., 1 c. 8,

Perennial herb, usually common in deciduous forests on soils covered with rich litter. Flowers April-May, white. Alt. 1900-2600 m.

A. coronaria L. var, **biflora** (DC.) Finet et Gagnep, in Bull. Soc. Bot. Fr. 51:60, 1904; Mukerjee, Bull. Bot. Surv. India 1 (1): 140, 1959.

A. biflora DC., Syst. 1:201, 1818; Hook. f. & Thoms., l. c. 7.

Perennial herb, often locally common on dry open slopes. Flowers March, pale purple. Alt. 1700-1900 m.

A. obtusiloba D. Don, Prodr. Fl. Nep. 194, 1825; Hook. f. & Thoms., l. c. 8.

Perennial herb, common on moist open slopes. Flowers May-August, white or bluish purple. Alt. 2000-3400 m.

Ceratocephalus falcatus (L.) Pers., Syn. Pl. 1:341, 1805; Tamura in Kitamura, Fl. Afghan. 122, 1960; Tutin, Flora Europaea 1:238, 1964.

Ranunculus falcatus L., Sp. Pl. 556, 1753; Hook. f. & Thoms., l. c. 16.

Annual herb, usually locally common along roadsides and open slopes. Flowers March, yellow. Alt. 1700-1900 m.

Clematis connata DC., Prodr. 1:4, 1824; Hook. f. & Thoms., l. c. 6.

Deciduous woody climber, along roadsides in the ravine and on scrubby slopes, rarer. Flowers September-November, yellowish. Alt. 1700-2000.

C. grata Wall., Pl. As. Rar. 1:83, 1830; Hook. f. & Thoms., l. c. 3.

Deciduous woody climber, quite common in scrubby areas, less so in forests. Flowers July-September, creamy white. Alt. 1700-2400 m. Vern. AGAR RANTH.

C. montana Buch-Ham. ex DC., Syst. 1:164, 1818; Hook. f. & Thoms., l. c. 2.

Deciduous woody climber, usually along scrubs. Flowers April-May, white. Alt. 1700-2000 m.

Ranunculus arvensis L., Sp. Pl. 555, 1753; Hook. f. & Thoms., l. c. 20.

Annual herb, usually in cultivated fields. Flowers April-May, yellow. Alt. 1700 m.

R. distans Royle, Ill. Bot. Himal. 53, 1834.

R. laetus Wall. ex Royle, Ill. Himal. 53, 1834.

R. laetus Wall. ex Hook. f. & Thoms., Fl. Brit. India 1:19, 1872; Ovchinnikov in Komarov, Fl. U. S. S. R. 7:472, 1937; Tamura in Kitamura, Fl. Afghan. 130, 1960.

Perennial herb, usually common in shaded damp places. Flowers April-June, yellow. Alt. 1700-2400 m.

R. hirtellus Royle, Ill. Bot. Himal. 53, 1834; Hook. f. & Thoms., l. c. 18.

Perennial herb, usually in moist shaded places. Flowers May-August, yellow. Alt. 2400-3100 m.

R. muricatus L., Sp. Pl. 555, 1753; Hook. f. & Thoms., l. c. 20.

Diffuse annual herb, in moist shaded situations, locally common. Flowers March-June, yellow. Alt. 1700-1800 m.

R. radicans Mey., Ledeb. Fl. Alt. 2:316, 1830; Mukerjee, Bull. Bot. Surv. India 1 (1-2): 103, 1959.

R. hyperboreus Rottb., var. *radicans* (Mey.) Hook. f. and Thoms., l. c. 18.

Small perennial herb, usually in crevices of precipitous rocks. Flowers July-August, yellow. Alt. 3100-3800 m.

R. scleratus L., Sp. Pl. 551, 1753; Hook. f. and Thoms., l. c. 19.

Annual herb, usually in shallow waters. Flowers May-July, yellow. Alt. 1700 m.

R. trichophyllus Chaix in Vill., Hist. pl. Dauph. 1:335, 1786; Cooke, Flora Europaea 1:237, 1964; Rao, Rec. Bot. Surv. India 18(2): 12, 1960.

R. aquatilis var. *trichophyllus* Hook. f. and Thomas., l. c. 16.

Water annual, submerged in running streams. Flowers May-November, white. Alt. 1700 m.

Thalictrum minus L. var. *major* (Jacq.) Hook. f. and Thoms., l. c. 14.

Tall perennial herb, on humus rich scrubby slopes. Flowers May-July, yellowish white. Alt. 1700-2800 m.

T. pauciflorum Royle, Ill. Bot. Himl. 52, 1833; Hook. f. and Thoms., l. c. 11.

Perennial herb, on scrubby slopes. Flowers July-August. Alt. 2700-3600 m.

T. pedunculatum Edgew., Trans. Linn. Soc. 10:27, 1846; Hook. f. and Thoms., l. c. 12.

Perennial herb, usually on humus rich soils. Flowers March-April, white. Alt. 1900-2300 m.

TODOPHYLLACEAE

Epimedium elatum Morr. and Decne., Ann. Sc. Nat. Ser. 2, 2:356, 1835; Hook. f. and Thoms., l. c. 112.

Perennial herb, usually among scrubs in partially shaded areas. Flowers April-May, yellowish white. Alt. 1700-2400 m.

Podophyllum hexandrum Royle, Ill. Bot. Himal. 64, 1839; Rao, Rec. Bot. Surv. India 18(2) : 14, 1960.

P. emodi Wall. ex Hook. f. & Thoms., l. c. 112.

Perennial herb, usually on humus rich soils. Flowers May-June, white. Alt. 2200-2900 m. Vern. BAN WANGUM

BERBERIDACEAE

Berberis huegeliana Schneider, Bull. Herb. Boissier Ser. 2:451, 1905; Chatterjee, Rec. Bot. Surv. India 16 (2):16, 1953.

Deciduous armed shrub, on scrubby slopes, rarely in forests. Flowers April-May, yellow, Alt. 1700-2000 m.

B. lycium Royle, in Trans. Linn. Soc. 17:94, 1837; Hook. f. & Thoms., Fl. Brit. India 1:110, 1872; Chatterjee, Rec. Bot. Surv. India 16 (2): 31, 1953.

Semievergreen armed shrub, common on dry exposed slopes. Flowers May-June, yellow. Alt. 1700-2400 m.

B. pachyacantha Koe'ne, Deutsche Dendrol. 170, 1893; Parker, For. Fl. Punjab etc. 12, 1918; Chatterjee, l. c. 31.

B. vulgaris Hook. f. & Thoms., l.c. 109 (non L.) Armed deciduous shrub, usually on humus rich soils. Flowers April-May, yellow. Alt. 1900-2500 m.

B. pseudoumbellata Parker, Kew Bull. 118, 1921; Chatterjee, l. c. 22.

B. vulgaris var. *brachybotrys* Hook. f. Thomas., l. c. 109 ex parte (non *B. brachybotrys* Edgew).

B. umbellata Parker, For. Fl. Punjab etc. 15, 1918 (non Wall.); Javeid, Kash. Sci. 5 (1-2): 74, 1968.

Deciduous armed shrub, common on scrubby slopes and in forests. Flowers April, yellow. Alt. 1700-2600 m.

FUMARIACEAE

Corydalis diphylla Wall., Tent. Fl. Nep. 54, 1824; Conventry, Wild Fls. Kash. 2:21, pl. 11, 1927.

C. rutaefolia Sibth., Fl. Graec. t. 667, 1816; Hook. f., Fl. Brit. India 1:122, 1872.

Slender perennial herb, locally common on bare humus rich soils. Flowers March, purplish. Alt. 1800-2300 m.

C. ramosa Wall. ex Hook. f., l. c. 125.

Perennial herb usually among scrubs. Flowers July-Sept. yellow. Alt. 2800-3700 m.

Fumaria indica (Haussk.) Pagsley, Journ. Linn. Soc. Bot. 44:313, 1919; Maheshwari, Fl. Delhi 56, 1963; Gupta, Fl. Nainitalensis 17, 1968.

F. parviflora Lamk., subsp. *vailantii* (Loisel) Hook. f., l. c. 128.

Spreading annual herb, usually a cultivation. Flowers April-May, pink. Alt. 1700 m. Vern. SHAHTAR

CRUCIFERAE

Alliaria petiolata (M. Bieb.) Cavara & Grande, Boll. Orto Bot. Napoli 3:418, 1913; Clapham et. al. Fl. Brit. Isles 179,

1962; Ball, Flora Europaea 1:267, 1964.

A. officinalis Andr. ex DC. Syst. 2:489, 1821; Kitamura, Fl. Afghan. 137, 1960.

Sisymbrium alliaria Scop., Fl. Carn. 2 ed., 2:26, 1772; Hook. f. & Anders., Fl. Brit. India 1:151, 1872.

Annual or biennial herb, usually locally common in shaded situations. Flowers April-June, white. Alt. 1700-2400 m.

Allysum minimum Willd., Sp. Pl. 3:464, 1800; Hook. f. & Anders., l. c. 141.

Small annual herb, usually on dry open slopes. Flowers March-April, yellow. Alt. 1700-1900 m.

Arabidopsis pumila (Steph.) Busch, in Fl. Cauc. Crit. 3, 4:457, 465, 1909; Kitamura, Fl. Afghan. 139, 1960; Ball, Flora Europaea 1:268, 1964.

Sisymbrium pumilum Steph. ex Willd., Sp. Pl. 3:507, 1800.

Annual herb, usually on wall tops, rarely in orchards. Flowers April-June, yellow. Alt. 1700 m.

A. thaliana (L.) Heynhold in Holl. & Heynhold, Fl. Schr. 1: 538, 1842; Schulz in Engler, Das pflanzenreich Heft 86: 270, 1924; Kitamura, Fl. Afghan. 141, 1960.

Sisymbrium thaliana (L.) Gay & Monn., in Ann. Sc. Nat. Bot. 1:800, 7:399, 1826 in adnot; Hook. f. & Anders., l. c. 148.

Annual herb, common on dry open slopes. Flowers March-April, white. Alt. 1700-2600 m.

A. wallichii (Hook. f. & Anders.) Busch., in Fl. Cauc. Crit. 3, 4:457, 1909; Kitamura, Fl. Afghan. 141, 1960.

Sisymbrium wallichii Hook. f. & Thoms., Journ. Linn. Soc. Bot. 5:158, 1861; Hook. f. & Anders., l. c. 149.

Perennial herb, occurring on dry rocky slopes. Flowers April-May, white or tinged red. Alt. 1700-2300 m.

Arabis amplexicaulis Edgew., Trans. Linn. Soc. 20:31, 1851; Hook. f. & Anders., l. c. 136.

Perennial herb, common on humus rich slopes, usually among scrubs. Flowers April-July, white. Alt. 1700-2600 m.

A. auriculata Lam. Encycl. 1:219, 1789; Hook. f. & Anders., 1. c. 135.

Annual herb, common on scrubby slopes and in forests. Flowers April-May, white. Alt. 1700-2500 m.

A. tenuirostris Schulz, Notizbl. Gart. Berlin 9:1066, 1925; Jafri, Notes Bot. Gard Edin. 1798, 1956; Razi, Rec. Bot. Surv. India 18 (1):4, 1959.

Annual herb, common in alpine pastures. Flowers May-September, pinkish, Alt. 2700-4000 m.

Barbarea vulgaris R. Br. in Aiton, Hort. Kew ed, 2, 4: 109. 1812; Ball, Flora Europaea 1:281, 1964.

B. vulgaris var. *taurica* (DC.) Hook. f. & Anders., 1. c. 134.

B. arcuata (Opiz ex Presl.) Reichenb., Flora 5:296, 1822.

Perennial herb, in moist situations, rare. Flowers April-June, yellow. Alt. 1800-2400 m.

Capsella bursa-pastoris (L.) Medic., Pflanzeng. 85, 1792; Hook. f. & Anders., 1. c. 159.

Annual herb, usually common in wastelands and cultivated fields. Flowers March-May, white. Alt. 1700-2100 m.

Vern. KRAL MOND.

Cardamine impatiens L., Sp. Pl. 655, 1753; Hook. f. & Anders., 1. c. 138.

Annual herb, common in damp situations. Flowers April-June, white. Alt. 1700-2400 m.

C. flexuosa With., Arr. Brit. Pl. ed. 3, 3:578, 1796; Jones, Flora Europaea 1:289, 1964.

Usually an annual herb, diffused, usually in rice fields. Flowers March-April, white. Alt. 1700-1800 m.

C. hirsuta L., Sp. Pl. 655, 1753; Hook. f., & Anders, l. c. 138.

Annual or biennial herb, in moist places. Flowers March-May, white. Alt. 1700-2600 m.

Coronopus didymus (L.) J. E. Smith, Fl. Brit. 214, 1800; Maheshwari, Fl. Delhi 57, 1963; Ball, Flora Europaea 1:333, 1964.

Lepidium didymus L., Mant. 92, 1767.

Senebiera pinnatifida DC., in Mem. Soc. Hist. Nat. Par. 144, t. 9, 1799; Rao, Bull. Bot. Surv. India 2:396, 1960.

Spreading annual herb, in abandoned areas. Flowers May-July, white. Alt. 1700 m.

Crambe cordifolia Stev. subsp. *kotschyana* (Boiss.) O. E. Schulz in Engl. Das Pflanzenreich Heft 70:236, 1919.

C. cordifolia Hook. f. & Anders., l. c. 165 (non Stev.).

Tall perennial herb, on humus rich ground usually below rocky cliffs. Flowers April-May, white. Alt. 2000-2500 m. *New record for Kashmir.*

Drobopsia nuda (Belang.) Stapf, in Denkschr. Math. Nat. Acad. Wiss. 51:30 1886; Kitamura, Fl. Afghan. 147, 1960.

Arabis nuda Belang., in Ann. Sc. Nat. Ser. 2, 17:54, 1842; Hook. f. & Anders., l. c. 137.

Annual herb, often locally common in forest openings and among scrubs. Flowers March-April, yellow. Alt. 1700-2600 m.

Erophila verna (L.) Chevall, Fl. Gen. Env. Paris 2:898, 1827; Walters, Flora Europaea 1:312, 1964; Kosch, Wild Fls. 26, Pl. 1, 1964.

E. vulgaris DC., Syst. 2:356, 1821; Hook. f. & Anders., l. c. 145.

Draba verna L., Sp. Pl. 642, 1753; Abrams, Ill. Fl. Pac States 2:292, 1944.

Small annual herb, fairly common on disturbed slopes. Flowers March-April, white, Alt. 1700-2100 m.

Erysimum hieracifolium L., Cent. Pl. 1:18, 1755; Hook. f. & Anders., l. c. 153.

Perennial herb, usually on rocky cliffs. Flowers April-June, orange yellow. Alt. 1800-2400 m.

E. melicentae Dunn, Kew Bull 336, 1920; Jafri. Notes Royal Bot. Gard. Edin. 17:108, 1959.

E. odoratum Hook. f. & Anders., l. c. 154. (non Ehrh.)

Biennial or perennial herb, on rocky cliffs. Flowers April-May, yellow. Alt. 1900-2500 m.

Malcolmia africana (L.) R. Br. in Aiton, Fort. Kew. ed. 2, 4:121, 1812; Hook. f. & Anders., l. c. 146.

Annual herb, usually along paths and on house tops. Flowers April-May, pink. Alt. 1700-1900 m.

Nasturtium officinale R. Br. in Aiton, Fort. Kew. ed. 2, 4:111, 1812; Hook. f. & Anders., l. c. 133; Valentine Flora Europaea 1:284, 1964.

Rorippa nasturtium-aquaticum (L.) Heyck in Chittenden, Dict. Gard. Encycl. Hort. 4:2265, 1809.

Perennial aquatic herb, usually in standing or slow moving waters. Flowers May-September, white. Alt. 1700 m.

Vern. NAG BABUR

Neslia paniculata (L.) Desv., Subsp. *thracica* (Valen.) Bornm., Oesterr. Bot. Zeitschr. 44:125, 1894; Meikle. Flora Europaea 1:316, 1964.

N. paniculata Boiss., Fl. Orient. 1:371, 1867 (non Desv.); Hook. f. & Anders., l. c. 164.

Annual herb, usually a weed of cultivation, also in wastelands, rare. Flowers May-July. Yellow. Alt. 1700-1800 m.

Rorippa islandica (Ceder) Barbea, Balat. Tav. Part. 2:392,

1900; Kitamura, Fl. Afghan. 159, 1960; Valentine, Flora Europaea 1:283, 1964.

Nasturtium palustre (L.) DC., Syst. 2:191, 1821 (non Crantz); Hook. f. & Anders., 1. c. 133.

Rorippa palustris (L.) Besser, Enum. Pl. Volh. 27, 1821; Abrams, Fl. Pac. States 2:278, 1944.

Annual or biennial herb, usually on moist soil [along rice fields and in ditches. Flowers April-October, yellow. Alt. 1700-1800 m.

R. sylvestris (L.) Besser, Enum. Pl. Volh. 27, 1820; Kosch Wild Fls. 112, pl. 236. 1964; Clapham et al., Fl. Brit. Isles. 173, 1962; Valentine, Flora Europaea 1:283, 1964.

Nasturtium sylvestris (L.) R. Br. in Aiton, Hort. Kew. ed. 2, 4:110, 1812.

Perennial creeping or ascending herb, usually in shaded moist situations. Flowers July-September, yellow. Alt. 1700 m.

Sisymbrium loeselii L., Cent. Pl. 1:18, 1755; Hook. f. & Anders., 1. c. 149.

Annual or biennial herb, usually in cultivated places and wastelands. Flowers April-July, October-December, yellow. Alt. 1700 m.

Thlaspi cardiocarpum Hook. f. & Anders., 1. c. 162.

Annual herb, on disturbed scrubby slopes. Flowers April-May, white. Alt. 1700-1900 m.

T. cochleariforme DC., Syst. 2:381, 1821 subsp. *griffithianum* (Boiss.) Jafri, Notes Royal Bot. Gard. Edin. 17:119, 1956.

T. alpestre Hook. f. & Anders., 1. c. 162.

Perennial herb, usually on humus rich soils. Flowers April-July, white. Alt. 1800-3100 m.

Turritus glabra L., Sp. Pl. 666, 1753; Kitamura, Fl. Afghan. 166, 1960; Rao, Rec. Bot. Surv. India 18(2):16, 1960.

Arabis glabra Crantz., Stirp. Austral. 1:36, 1762; Hook. f. & Anders., 1. c. 135.

Annual or biennial herb, usually on savana slopes. Flowers May-July, white. Alt. 1700-2400 m.

CARYOPHYLLACEAE

Arenaria neelgherensis Wight & Arn., Prodr. 43, 1830; Edgew. & Hook. f., Fl. Brit. India 1:239, 1874.

Spreading annual herb, usually in forests. Flowers May-June, white. Alt. 2200-2600 m.

A. serpyllifolia L., Sp. Pl. 423, 1753; Edgew. & Hook. f. 1. c. 239.

Annual herb, common on disturbed slopes and in cultivated fields. Flowers April-June, white. Alt. 1700-2200 m.

Cerastium cerastoides (L.) Britt., in Mem. Torrey Bot. Club 5:150. 1894; Mizushima in Kitamura, Fl. Afghan. 160, 1960; Majumdar, Journ. Indian Bot. Soc. 44(1):140, 1965.

C. trigynum Vill., Hist Pl. Dauph. 3:645, 1789; Edgew. & Hook. f., 1. c. 227,

Spreading perennial herb, on moister slopes. Flowers May-September, white. Alt. 2600-3700 m.

C. fontanum Baumg., Enum. Strixp. Transs. 1:425, 1816. subsp. *triviale* (Link) Jalas, in Arch. Soc. Zool.-Bot. Fenn. Vanamo 18(1):63, 1963; Cullen in Davis, Fl. Turkey 2:80, 1967.

C. vulgatum var. *triviale* (Link) Edgew. & Hook. f., 1. c. 228.

C. caespitosum Gilib, Fl. Lith. 5:159, 1781.

C. holosteoides Fries subsp. *triviale* (Link) Moschl var. *hallaisanense* (Nakai) Mizushima in J. Jap. Bot. 38:149, 1963; Majumdar, Journ. Indian Bot. Soc. 44(1):140, 1965.

Perennial herb, common in moist shaded situations. Flowers April-July, white. Alt. 1700-2800 m.

C. glomeratum Thuill., Fl. Par. ed. 2:225, 1799; Majumdar, Journ. Indian Bot. Soc. 44(1):140, 1965; Sell and White-

head. *Flora Europaea* 1:144, 1964; Cullen in Davis, *Fl. Turkey* 2:82, 1967.

C. vulgatum var. *glomerata* (Thuill.) Edgew. & Hook. f. 1. c. 228.

Annual herb, usually a weed of cultivation, also on dry open slopes. Flowers March-May, white. Alt. 1700-1900 m.

Cucubalus baccifer L., *Sp. Pl.* 414, 1753; Edgew. & Hook. f., 1. c. 222.

Diffuse perennial herb, usually in forests. Flowers May-June, greenish-white. Alt. 1800-2600 m.

Dianthus jacquemontii Edgew. & Hook. f., 1. c. 214; Coventry, *Wild Fls. Kash.* 3:37, pl. 19, 1930.

Perennial herb, on dry rocky slopes. Flowers May-June, white. Alt. 1700-1900 m.

Gypsophila cerastoides D. Don, *Prodr. Fl. Nep.* 213, 1825; Edgew. & Hook. f., 1. c. 216.

Perennial herb, in alpine pastures. Flowers July-September, pale pink. Alt. 3000-3800 m.

Holosteum umbellatum L., *Sp. Pl.* 88, 1753; Edgew. & Hook. f., 1. c. 227.

Annual herb, usually locally common on disturbed slopes. Flowers March-April, white. Alt. 1700-2300 m.

Lychnis coronaria (L.) Desr. in Lam., *Encycl. Meth. Bot.* 3:643, 1792; Edgew. & Hook. f., 1. c. 222.

Perennial tomentose herb, often very common on dry rocky slopes, less so in forests. Flowers July-September, purple. Alt. 1700-2300 m.

Myosoton aquaticum (L.) Moench, *Meth.* 225, 1794; Majumdar, *Journ. Indian Bot. Soc.* 44(1):140, 1965; Clapham, *Flora Europaea* 1:146, 1964; Coode in Davis, *Fl. Turkey*, 2:73, 1967.

Cerastium aquaticum L., *Sp. Pl.* 439, 1753.

Malachium aquaticum (L.) Fries, *Fl. Hall.* 77, 1817;

Talmatchev, in Fl, URSS 6:430, 1936; Javeid, Fl. Srinagar 1:265, 1970.

Perennial herb, usually in shaded damp situations. Flowers April-June, white. Alt. 1700-2200 m.

Pseudostellaria cashmiriana Schaftlein, in Phyton 7:195, 1957; Mizushima in Kitamura, Fl. Afghan. 114, 1960; Majumdar, l. c. 140.

Stellaria bulbosa sensu Edgew. & Hook. f., l. c. 231 (pro parte).

Perennial bulbous herb, usually in coniferous forests. Flowers, May-June, white. Alt. 2400-2700 m.

Sagina apetala Ard., Animadv. Bot. Spec. 2:22, 1763; Clapham & Jardine, Flora Europaea 1:147, 1964; Cullen in Davis, l. c. 91.

Annual herb, on pastured slopes, Flowers April-May, greenish. Alt. 1800-1900 m. *New record for India.*

S. procumbens L., Sp. Pl. 128, 1753; Edgew. & Hook. f. l. c. 242.

Perennial herb, usually along stream banks, also moist shaded places. Flowers May-August, greenish white. Alt. 1700-2400 m.

S. saginoides (L.) Karst., Deutsch. Fl. Pharm.-med. Bot. 539, 1882; *S. procumbens* var. *pentamera* Edgew. & Hook. f. l. c. 343.

Perennial herb, usually on moister slopes. Flowers May-September, greenish white. Alt. 2400-3300 m.

Silene tenuis Willd., Enum. Hort. Berol. 474, 1809; Edgew. & Hook. f., l. c. 219.

Perennial herb, on alpine slopes. Flowers July-September, yellowish brown. Alt. 2800-3800 m.

S. vulgaris (Moench) Garcke, Fl. Nord Mittel-Deutschl. ed. 9:64, 1869; Charter and Walters, Flora Europaea 1:168, 1964; Coode & Cullen in Davis, l. c. 210.

Behen vulgaris Moench, Meth. 709. 1794.

Silene inflata Sm., Fl. Brit. 467, 1800; Edgew. & Hook. f., 1. c. 218.

S. venosa (Gilile) Aschers, Fl. Brand. 86, 1864; Raizada, Indian For. 92(5):323, 1966.

S. cucubalus Wibel, Prim. Fl. Wort. 241, 1799; Mizushima in Kitamura Fl. Afghan. 116, 1966.

Perennial herb, usually fairly common in shaded situations in forests. Flowers May-July, white. Alt. 1700-2800 m.

S. wahlbergella Chowdhuri, in Notes Royal Bot. Gard. Edin. 2:237, 1957; Majumdar, 1. c. 647.

Lychnis apetala L., Sp. Pl. 1:437, 1753; Edgew. & Hook. f., 1. c. 222.

Perennial herb, usually among scrubs. Flowers July-September, dull purple. Alt. 2800-3500 m.

Spergula arvensis L., Sp. Pl. 440, 1753; Edgew. & Hook. f. 1. c. 243.

Annual herb, on dry scrubby slopes, rare. Flowers May-June, white. Alt. 1700-1800 m.

Stellaria media Vill., Hist. Pl. Dauph. 3:615, 1789; Edgew. & Hook. f., 1. c. 230.

Annual herb, common on somewhat shaded disturbed slopes. Flowers March-April, November-December, white, Alt. 1700-2400 m.

PORTULACACEAE

Portulaca oleracea L., Sp. Pl. 445, 1753; Dyer in Hook. f., 1. c. 427.

Annual herb, usually along pathways and cultivated fields. Flowers July-November, yellow. Alt. 1700-1900 m.

Vern NUNAR

POLYGONACEAE

Fagopyrum cymosum Meissen. in Wall., Pl. As. Rar. 3:63; Hook. f., Fl. Brit. India 5:55, 1886.

Tall perennial herb, among scrubs in the ravine. Flowers

August-September, white. Alt. 1700-2000 m. Vern TSOK HAK

Oxyria digyna (L.) Hill., Hort. Kew. 158, 1769; Hook. f. 1. c. 58.

Perennial herb, usually along glacial streams. Flowers July-August, pink. Alt. 3000-3800 m.

Polygonum affine D. Dcn, Prodr. Fl. Nep. 70, 1825; Hook. f. 1. c. 33.

Perennial matted herb, abundant on alpine slopes. Flowers June-August, purple. Alt. 3200-3900 m.

P. alpinum All., Melang. Philos. Math. Soc. Roy. Turin (Misc.) 5:94, 1774; Hook. f., 1. c. 49; Coventry, Wild Fls. Kash. 2:97, pl. 49, 1927.

Tall perennial herb, usually locally common on open humus rich slopes. Flowers May-June, white. Alt. 2200-2700 m.

Vern TSOK LADAR

P. amphibium L., Sp. Pl. 361, 1753; Hook. f., 1. c. 34.

Perennial aquatic herb, common along the water reservoir. Flowers August-October, purple. Alt. 1700 m.

P. amplexicaule Don, Prodr. Fl. Nep. 70, 1825; Hook. f., 1. c. 32,

Perennial herb, fairly common in forests and on humus rich slopes. Flowers June-September, purple to almost white. Alt. 1700-2900 m.

Vern. MATS RAND

P. aviculare L., Sp. Pl. 362, 1753; Hook. f., 1. c. 26.

Annual spreading herb, usually along roadsides, also under *Platanus* shade. Flowers June-October, pink. Alt. 1700-2100 m.

P. barbatum L., subsp. *gracile* Danser, in Bull. Jard. Bot. Buitene (Ser. 3) 8:446, 1927; Maheshwari, Fl. Delhi 306. 1963.

P. serrulatum Hook. f., 1. c. 38 (non Lag.).

Perennial herb, rooting below, usually in depressions in shaded situations. Flowers July-October, pink. Alt. 1700-1900 m.

P. delicatulum Meissn. in DC., Prodr. 14, 1:127, 1856; Hook. f., l. c. 24.

Delicate annual herb, on wet slopes. Flowers July-Sept. yellowish white. Alt. 3100-3800 m.

P. dumentorum L., Sp. Pl. ed. 2, 522, 1762; Hook. f., l. c. 54.

Annual twining herb, common in ravine among scrubs and tall herbaceous species. Flowers August-October, whitish. Alt. 1700-1900 m.

P. hydropiper L., Sp. Pl. 361, 1753; Hook. f., l. c. 39.

Annual herb, locally common along rice fields and in damp situations. Flowers June-October, pink. Alt. 1700-2100 m.

P. lapathifolium L. var. *laxa* (Reichnb.) Hook. f., l. c. 35.

Annual herb, usually in damp situations and marshes. Flowers August-November, pink. Alt. 1700-1800 m.

P. nepalensis Meissn., Monogr. 84, t. 7, f. 2, 1826; Kitamura, Fl. Afghan. 92. 1960; Raizada, Indian For. 92 (5): 321, 1966. *P. alatum* Buch.-Ham. ex Spreng. Syst. 154, 1821; Hook. f., l. c. 41.

Erect or spreading annual herb, usually common in damp shaded situations. Flowers June-October, pale pink to white. Alt. 1700-2000 m.

P. tubulosum Boiss., Diagn. Ser. 1:83, 1843; Hook. f., l. c. 27.

Spreading annual herb, on dry slopes, roadsides and in cultivated fields. Flowers May-October, pinkish white. Alt. 1700-1900 m.

Rheum webbianum Royle, Ill. Bot. Himal. 318, t. 17a, 1839; Hook. f., l. c. 57.

Perennial herb, usually among junipers on rocky cliffs. Flowers July-August, yellowish white. Alt. 3200-3700 m.

Vern. PAMB HAK

Rumex acetosa L., Sp. Pl. 337, 1753; Hook. f., l. c. 60.

Tall slender perennial herb, on moister shaded slopes.

Flowers June-August, pinkish. Alt. 2100-3000 m.

Vern. TSOK TSIN

R. dentatus L., Mant. Alt. 226, 1771; Hook. f., l. c. 59.

Annual herb, usually locally common in deep situations. Flowers May-June, greenish. Alt. 1700-2000 m.

R. hastatus Don, Prodr. Fl. Nep. 74, 1825; Hook. f., l. c. 60.

Perennial herb, locally common at few places in wastelands. Flowers May-June, pale pink. Alt. 1700-1900 m.

R. patientia L., Sp. Pl. 33, 1753, subsp. *orientalis* (Bernh.) Danser, in Neederl. Kruidk. Arch. 11, 1923; Kitamura, Fl. Afghan. 96, 1960; Gupta, Fl. Nainitalensis 296, 1968. *R. orientalis* Bernh. ex Schult. f., Syst. 7:1433, 1830; Hook. f., l. c. 58.

Tall perennial herb, locally common in deep shaded situations. Flowers May-June, pale yellow. Alt. 1700-2000 m.

Vern. ABUI

ILLECEBRACEAE

Herniaria cashemiriana J. Gay, in Duch Rev. Bot. 2:370 1848; Hermann, Fedde Repert. 42:214, 220, 1937.

Perennial spreading herb, on dry rocky slopes. Flowers April-July, green. Alt. 1700-2000 m.

CHENOPODIACEAE

Chenopodium album L., Sp. Pl. 219, 1753; Hook. f., Fl. Brit. India 5:3, 1886,

Annual herb, usually a weed of cultivation, rarely along pathways. Flowers July-September, green. Alt. 1700-2200 m.

C. botrys L., Sp. pl. 219, 1753; Hook. f., l. c. 4.

Annual herb, usually along pathways and cultivated fields. Flowers June-August, green. Alt. 1700-2400 m.

C. murale L., Sp. pl. 219, 1753; Hook. f., l. c. 4.

Annual herb, usually in shaded wastelands. Flowers August-October, green. Alt. 1700 m.

AMARANTHACEAE

Achyranthes bidentata Blume, Bijdr. 545, 1825; Hook. f., Fl. Brit. India 4:730, 1885.

Perennial herb, among scrubs in ravine, sometimes in rock crevices. Flowers July-October, greenish yellow. Alt. 1700-1900 m.

Amaranthus caudatus L., Sp. pl. 990, 1753; Hook. f., l. c. 719.

Annual herb, usually [a weed of cultivation, rarely along pathways. Flowers August-October, green. Alt. 1700-2000 m.

LYTHRACEAE

Ammania auriculata Willd., Hort. Berol. 1, t. 7, 1806, var. **arenaria** (H. B. & K.) Koehne in Engl., Bot. Jahrb. 1:245 1880; Koehne in Engl., Das Pflanzenreich Heft 17:46, 1903. *A. senegalensis* DC., Prodr. 2:77, 1828 (non Lam.); Clarke in Hook. f., Fl. Brit. India 2:570, 1879.

Annual herb, usually along rice fields, Flowers July-September, purplish green. Alt. 1700-1800 m.

Lythrum salicaria L. Sp. Pl. 446, 1753; Koehne in Engl., Das Pflanzenreich Heft 17:73, 1903.

L. cashemirianum Royle, Ill. Bot. Himal. 213. t. 44, f. 1, 1834.

Perennial herb, usually in damp situations, often along mountain drains. Flowers July-October, bluish purple. Alt. 1700-2100 m.

Rotala densiflora (Roth.) Koehne in Engl., Bot Jahrb. 1:164, 1880 subsp. **uliginosa** (Roth.) Koehne l.c. 165; Koehne in Engl., Das Pflanzenreich Heft 17:36, 1903.

Annual herb, usually common along rice fields. Flowers July-October, purplish. Alt. 1700-1800 m.

ONAGRACEAE

Circaea alpina L., subsp. **imaicola** (Aschers et Magn.) Kitamura Fl. Afghan. 279, 1960.

C. alpina sensu Clarke in Hook. f., Fl. Brit. India 2:589, 1879 (non L.).

Annual herb, along glacial streams. Flowers June-September, whitish. Alt. 2700-3300 m.

C. cordata Royle, Ill. Bot. Himal. 211, t. 43, f. 1. 1834; Clarke in Hook. f., l. c. 589.

Annual herb, usually under forest shade. Flowers June-July. Alt. 2100-2600 m.

Epilobium cylindricum D. Don, Prodr. Fl. Nep. 222, 1825; Haussk., Monogr. Epilobium 200, 1884; Gupta Fl. Nainitalensis 137, 1968.

E. roseum Schreb. var. *cylindricum* (D. Don) Clarke in Hook. f., l. c. 585.

Perennial herb, usually along streams. Flowers July-September, pale pink. Alt. 1700-1800 m.

E. laxum Royle, Ill. Bot. Himal. 211, t. 43, f. 2. 1835; Raven, in Ann. Naturh. Mus. Wein 65:369, 1962; Kitamura, Add. Corr Fl. Afghan. 111, 1966.

E. amplexans. Benth. ex Haussk., in Oester. Bot. Zeitschr. 29, 1879.

E. duthie Haussk., Monogr. Epilobium 205, 1884.

Annual herb, usually on moister slopes. Flowers July-September, pink. Alt. 2500-3100 m.

E. hirsutum L. var. *sericeum* Benth. ex Clarke in Hook. f., l. c. 584.

Tall perennial herb, usually along mountain drains and in cultivated fields. Flowers July-September, bright pink. Alt. 1700-1800 m.

E. parviflorum (Schreb.) DC., Prodr. 3:43, 1828; Clarke in Hook. f., l. c. 584.

Perennial herb, usually in damp situations and along rice fields. Flowers July-September, pink. Alt. 1700-1800 m.

Oenothera drummondii Hook., Bot. Mag. t. 3361; Bailey, Man. Cult. Plants 738, 1949.

Perennial herb, locally common in wastelands at a few places. Flowers July-September, yellow. Alt. 1700 m.

CALLITRICHACEAE

Callitriche stagnalis Scop., Fl. Carn. 2:251, 1772; Clarke in Hook f., l. c. 434.

Aquatic annual, often forming large masses in ponds. Flowers September-November, green. Alt. 1700 m.

GENTIANACEAE

Centaurium meyeri (Bunge) Druce, in Rep. Bot. Exch. Cl. Brit. Isles 1916:613, 1919: Kitamura, Fl. Afghan. 303, 1960.

Erythraea meyeri Bunge in Ledeb., Fl. Alt. 1:210, 1829; Clarke in Hook. f., Fl. Brit. India 4:102, 1883.

Annual herb, usually in moist situations, rare. Flower June-July, white. Alt. 1700 m.

Gentiana carinata Griseb, Gentian 304; Clarke in Hook. f., l. c. 113.

Annual herb, in alpine pastures. Flowers May-July, blue. Alt. 2800-3600.

G. tenella Fries, Act. Hafn. 10:436, t. 2, f. 6; Clarke in Hook. f., l. c. 109.

Annual herb, in alpine pastures. Flowers July-August, bluish purple. Alt. 3100-3800 m.

Jaeschkea latisepala Clarke, in Journ. Linn. Soc. 14:441; Clarke in Hook. f., l. c. 119.

Annual herb, usually among scrubs and in damp situations. Flowers July-September, bluish. Alt. 3100-3700 m.

MENYANTHACEAE

Nymphoides peltatum Kuntze, Rev. Gen. Pl. 1891; Bailey, Man. Cult. Plants 808, 1949.

Limnanthemum nymphoides Link, Fl. Pottug. 1:344; Clarke in Hook. f., l. c. 131.

Perennial aquatic herb, in ponds and ditches, rarely in rice fields. Flowers August-November, yellow. Alt. 1700 m.

Vern. KHUR

PRIMULACEAE

Anagallis arvensis L., Sp. Pl. 148, 1753; Hook. f., Fl. Brit. India 3:506, 1882.

Weak annual herb, a weed of cultivation and in wastelands. Flowers April-July, pink. Alt. 1700-1900 m.

Androsace primuloides Duby in DC., Prodr. 7:61, 1844; Pax in Knuth, Engl. Das Pflanzenreich Heft 22:183, 1905.

A. sarmentosa Wall. var. *primuloides* (Duby) Hook. f., l. c. 498.

Perennial herb, on alpine slopes. Flowers July-August, purplish. Alt. 3200-3700

A. rotundifolia Hardw. in As. Res. 6:350, 1795, var. *elegans* (Duby) Knuth in Engl. l. c. 177.

A. rotundifolia Hardw. var. *macrocalyx* Watt., in Journ. Linn. Soc. 20:16, 1882; Hook. f., l. c. 496.

Perennial herb, usually on dry rocky slopes. Flowers May-June, white or purplish. Alt. 1700-1900 m.

A. sempervivoides Jacq. ex Duby in DC., Prodr. 8:50, 1844; Hook. f. l. c. 497.

Perennial stoloniferous herb, on alpine slopes. Flowers July-September, purplish. Alt. 3100-3700 m.

Primula denticulata Smith, Exot. Bot. 2:109, t. 114, 1805; Hook f., l. c. 485.

Perennial herb, in moist situations, often along water drains. Flowers April-May, purple. Alt. 2600-3000 m.

P. rosea Royle, Ill. Bot. Himal. 311, t. 75, f. 1, 1834; Sprague, Kew Bull. 308, 1933; Hook. f., l. c. 488; Coventry, Wild Fls. Kash. 1:61, pl. 30, 1923.

Perennial herb, usually in forests, less commonly in pastures. Flowers May-June, rosy. Alt. 2600-3300 m.

PLANTAGINACEAE

- Plantago depressa** Willd., Enum. Hort. Berol. Suppl. 8, 1813;
Pilger in Engl., Das Pflanzenreich Heft 102:272, f. 29,
1937; Kitamura, Add. Corr. Fl. Afghan. 139, 1966.
P. tibetica Hook. f., Fl. Brit. India 4:706, 1885.

Perennial scapigerous herb, usually under tree shade in wastelands. Flowers May-October green. Alt. 1700-1900 m.

- P. himalaica** Pilger in Engl., Das Pflanzenreich Heft 102:62,
1937; Rao, Rec. Bot. Surv. India 18 (2): 52, 1960.
P. brachyphylla Edgew. ex DCne. in DC., Prodr. 13,
1:696, 1852; Hook. f., l. c. 706.

Perennial scapigerous herb, common in alpine pastures. Flowers June-September, green. Alt. 2900-3800 m.

- P. lanceolata** L., Sp. pl. 113, 1753; Hook. f., l. c. 706.

Perennial scapigerous herb, common in pastures and scrubby slopes. Flowers May-November, green. Alt. 1700-2300 m.

Vern. GUL

- P. major** L., Sp. Pl. 112, 1753; Hook. f., l. c. 706.

Perennial scapigerous herb, usually in damp situations, Flowers June-October, green. Alt. 1700-2600 m.

Vern. GUL

CRASSULACEAE

- Sedum adenotrichum** Wall. ex Hook. f. & Thoms. Journ. Linn. Soc. Bot. 2:101, 1853; Hook. f., l. c. 420.

Perennial herb, forming rosettes, usually in rock crevices. Flowers May-June, dirty white. Alt. 1700-2300 m.

- S. ewersii** Ladeb., Fl. Alt. 2:191, 1830; Clarke in Hook. f., l. c. 421; Coventry, l. c. 41, pl. 21.

Perennial herb, forming patches on moister rocks. Flowers September-November, bluish purple. Alt. 1800-1900 m.

- Sempervivum sedoides** Decne. in Jacq., Voy. Bot. t. 74, 1844;
Clarke in Hook. f., l. c. 423.

Perennial herb, forming rosettes, on moister rocks. Flowers August-October, yellowish white. Alt. 2400-2700 m.

SAXIFRAGACEAE

Astilbe rivularis Ham. in D. Don, Prodr. Fl. Nep. 210, 1825;
Clarke in Hook. f., Fl. Brit. India 2:389, 1878.

Perennial herb, usually in shaded situations among rocks.
Flowers June-July, greenish yellow. Alt. 1800-2200 m.

Bergenia ciliata (Haw.) Sternb., Rev. Saxifr. Suppl. 2:2, 1835;
Yeo, Kew Bull. 132, 1966.

B. ligulata Engl., Bot. Zeitg. 9:26, 840, 1868 (nomen
illegit).

Saxifraga ligulata Wall. in Asiat. Res, 13:398, 1820
(nomen illegit).

Bergenia himalaica Boiss., in Notulae Syst. Kom. 16:98,
1854.

Perennial herb, on moist rocks and under forest shade.
Flowers April-May, purplish. Alt. 1900-2600 m.

Vern. PAHAND

B. stracheyi (Hook. f. & Thoms.) Engl., in Bot. Zeitg. 26:842
1868; Blatter, Beaut. Fl. Kash. 1:126, t. 23, 1927; Yeo,
Kew Bull. 128, 1966.

Saxifraga stracheyi Hook. f. & Thomas, Journ. Linn.
Soc. Bot. 2:61, 1858; Clarke in Hook. f., l. c. 398.

Perennial herb, on moist rocky slopes. Flowers June-July,
purplish. Alt. 3100-3900 m.

Saxifraga diversifolia Wall. ex Sternb., l. c. 25, t. 22; Clarke in
Hook. f., l. c. 393; Coventry, Wild Fls. Kash. 3:53, pl.
27, 1930.

Perennial herb, among scrubs and on open alpine slopes.
Flowers July-September, yellow. Alt. 2900-3400 m.

S. sibirica L., Sp. Pl. ed. 2, 557, 1762; Clarke in Hook. f., l. c.
390; Coventry, l. c. 41, pl. 21.

Perennial herb, usually below moist rocks and along glacial
streams. Flowers July-August, white. Alt. 3100-3700 m.

UMBELLIFERAE

Angelica glauca Edgew., Trans. Linn. Soc. 20:53. 1846; Clarke
in Hook. f., Fl. Brit. India 2:706, 1879.

Perennial herb, usually among scrubs on humus rich soils. Flowers June-August, light purple. Alt. 2000-3200 m.

A. archangelica var. **himalaica** (Clarke) Singh *comb. nov.* *Archangelica officinalis* Hoff. var. *himalaica* Clarke in Hook. f., l. c. 707.

Perennial herb, usually along beds of seasonal streams. Flowers June-July, white. Alt. 2300-3000 m.

Anthriscus nemorosa (Bieb.) Spreng., Umb. Prodr. 27, 1813; Clarke in Hook f., l. c. 693.

Perennial herb, locally common at a few places in ravine along roadsides. Flowers April-May, white. Alt. 1700-1800 m.

Bunium persicum (Boiss.) B. Fedtsch. Rastit. Turkest. 612, 1915; Raizada, Indian For. 84(8): 475, 1958; Kitamura, Fl. Afghan. 283, 1960.

Carum bulbocastanum Clarke in Hook. f., l. c. 181.

Perennial herb, common locally on dry scrubby slopes. Flowers May-June, white. Alt. 1700-1900 m. Vern ZEUR

Bupleurum candolii Wall. ex DC., Prodr. 4:131, 1830; Clarke in Hook. f., l. c. 674.

Perennial herb, usually on moist shaded rocks, in crevices. Flowers June-July, yellow Alt. 1800-2700 m.

B. falcatum L. var. **marginata** (Wall.) Clarke in Hook. f., l. c. 676.

Perennial herb, usually locally common on dry scrubby and savana slopes. Flowers June-August, yellow Alt. 1700-2200 m.

B. jucundum Kurz, in Seem Journ. Bot. 5:240, 1867; Clarke in Hook. f., l. c. 675; Wolff in Engl., Das Pflanzenreich. Heft 43:123, 1910.

Perennial herb, usually common under forest shade. Flowers May-July, yellow. Alt. 2300-2900 m.

B. longicaule Wall. ex DC., Prodr. 4:131, 1830. var. **himalensis** (Klotsch) Clarke in Hook. f., l. c. 677; Wolff, l. c. 123.

Perennial herb, usually common in alpine pastures. Flowers June-September, black. Alt. 3000-3500 m.

Chaerophyllum acuminatum Lindl. in Royle, Ill. Bot. Himal. 232, 1839; Clarke in Hook. f., l. c. 691.

Perennial herb, usually in forest openings and savana slopes. Flowers June-August, white. Alt. 1800-2900 m.

C. capnoides (Decne.) Benth., in Gen. Pl. 1:808, 1867; Clarke in Hook. f., l. c. 691.

Butinia capnoides Decne. in Jacq.. Voy. Bot. 70, t. 80, 1840.

Tuberous rooted perennial herb, in forests, rarer. Flowers April-May, white. Alt. 1700-1800 m.

C. reflexum Lindl. in Royle, l. c. 233; Clarke in Hook. f., l. c. 691.

Perennial herb, usually in forest openings, locally common. Flowers June-August, white. Alt. 1700-2800 m.

C. villosum Wall ex DC., Prodr. 4:225, 1830; Clarke in Hook. f., l. c. 690.

Perennial herb, usually in forest openings. Flowers June-August, white. Alt. 1700-2800 m.

Daucus carota L., Sp. Pl. 242, 1753; Clarke in Hook. f., l. c. 718.

Biennial herb, a weed of cultivation, rarely in wastelands. Flowers June-September, white. Alt. 1700-1800 m.

Eryngium planum L., Sp. pl. 233, 1753; Charter, Flora Europaea 2:322, 1968.

E. coeruleum Clarke in Hook. f., l. c. 670 (non Bieb., nec. Gilib.)

Perennial herb, locally common in orchards and cultivated areas. Flowers July-August, bluish. Alt. 1700 m.

E. billardieri Delaroche, Eryng. 25, t. 2; Clarke in Hook. f., l. c. 670.

Perennial herb, common in wastelands and roadsides. Flowers June-August, bluish. Alt. 1700-1900 m.

Ferula jaeschkeana Vatke, Append. in Sem. Hort. Berol. 2, 1876; Clarke in Hook. f., l. c. 708.

Tall perennial herb, locally common on dry slopes. Flowers April-May, yellow. Alt. 1700-2400 m.

Vern. HAPUT KANPUR

Foeniculum vulgare Mill., Gard. Dist. 8 ed., n. 1, 1768; Maheshwari, Fl. Delhi 177, 1963.

Perennial herb, locally common in wastelands at a few places. Flowers June-November, yellow. Alt. 1700-1800 m.

Vern. JUNGLI BODIAN

Heracleum candicans Wall. ex DC., Prodr. 4:192, 1830; Clarke in Hook. f., l. c. 714.

Tall perennial herb, locally common on scrubby and savana slopes. Flowers May-July, white. Alt. 1700-3100 m.

Pimpinella diversifolia DC., Prodr. 4:122, 1830; Clarke in Hook. f., l. c. 688.

Perennial herb, usually on humus rich soils. Flowers July-August, white. Alt. 2200-2500 m.

Scandix pecten-veneris L., Sp. pl. 256, 1753; Clarke in Hook. f., l. c. 692.

Annual herb, usually a weed of cultivation, also in wastelands. Flowers April-June, white. Alt. 1700-1800 m.

Selinum wallichianum (DC.) Raizada & Saxena ex Raizada, Indian For. 92 (5):323, 1966; Gupta, Fl. Nainitalensis 144, 1968.

S. tenuifolium Wall. ex DC., Prodr. 4:181, 1830 (non Salisb.)

Perennial herb, usually in forests. Flowers June-July, white. Alt. 2000-2900 m.

Seseli sibiricum Benth. ex Clarke in Hook. f., l. c. 693.

Perennial herb, usually on rocky cliffs. Flowers July-Aug., white. Alt. 1800-2600 m.

Sium latijugum Clarke in Hook. f., l. c. 683.

Perennial herb, growing in marshy places and in shallow waters. Flowers July-November, white. Alt. 1700-1900 m.

Torilis japonica (Houtt.) DC., Prodr. 4:219, 1830; Cannon, Flora Europaea 2:371, 1968.

Caucalis anthriscus Scop. in Don, Prodr. Fl. Nep. 183, 1825 (non Gaertn.)

Annual herb, usually among scrubs and borders of rich fields. Flowers July-September, white or tinged pink. Alt. 1700-2100 m.

T. nodosa (L.) Gaertn., Fruct. Sem. 1:82, 1788; Cannon, Flora Europaea 2:371, 1968.

Annual herb, on dry scrubby slopes and in pastures. Flowers May-June, white. Alt. 1700-1800 m.

Turgenia latifolia Hoffm., Gen. Umbell. 59, 1814; Kitamura, Fl. Afghan. 291, 1960; Heywood, Flora Europaea 2:372, 1968.

Caucalis latifolia L., Syst. Nat. ed. 2:205, 1768; Clarke in Hook. f., l. c. 718.

Annual herb, usually on wall tops, rarely in wastelands. Flowers May-June, white or tinged purple. Alt. 1700 m.

VALERIANACEAE

Valeriana hardwickii Wall. in Roxb., Fl. Ind. ed. Carey & Wall. 2:166, 1824; Clarke in Hook. f., Fl. Brit. India 3:213, 1881.

Perennial herb, usually among herbaceous vegetation on humus rich soils. Flowers April-July, white. Alt. 1900-3100 m.

V. jatamansi Jones in As. Res. 2:405, 416, 1790; Kihara, Fauna & Flora Nep. Himal. 1:237, 1955; Gupta, Fl. Nainitalensis 170, 1968.

V. wallichii DC., Mem. Valer. 15, t. 4, 1832; Clarke in Hook. f., l. c. 213.

Perennial herb, usually under forest shade. Flowers April-June, white. Alt. 2100-2600 m.

V. stracheyi Clarke in Hook. f., l. c. 212.

Perennial herb, usually in crevices of shaded rocks. Flowers June-September, pinkish white. Alt. 1700-2800 m.

Valerianella muricata (Stev.) Baxt., in London Hort. Brit. Suppl. 3:654, 1839.

Annual herb, locally common in pastures and wastelands. Flowers April-June, pale pink. Alt. 1700-1800 m.

DIPSACACEAE

Dipsacus mitis Don, Prod. Fl. Nep. 161, 1825; Kitamura, Fl. Afghan. 374, 1960; Gupta, Fl. Nainitalensis 172, 1968; *D. inermis* Wall. var. B in Roxb., Fl. Ind. ed. Wall. 1:367, 1824; Clarke in Hook. f., l. c. 217.

Tall perennial herb, on humus rich soils among scrubs and in forests. Flowers July-September, creamish. Alt. 1700-3100 m.

Vern. WOPUL HAK

Scabiosa speciosa Royle, Ill. Bot. Himal. 245, t. 55, 1835; Clarke in Hook. f., l. c. 219.

Perennial herb, usually on open slopes. Flowers July-September, pinkish. Alt. 2300-2900 m.

CAMPANULACEAE

Asyneuma thomsonii (Clarke) Bornm., in Beih. Bot. Centralb. 38, 2:348, 1921; Kitamura, Fl. Afghan. 377, 1960.

Phyteuma thomsonii Clarke in Hook. f., Fl. Brit. India 3:438, 1881.

Perennial herb, usually in coniferous forests, often on humus rich soils. Flowers April-June, lilac. Alt. 1700-2400 m.

Campanula aristata Wall in Roxb., Fl. Ind. ed. Wall. 2:98, 1824; Clarke in Hook. f., l. c. 441.

Annual herb, usually in alpine pastures, along water drains. Flowers July-September, bluish. Alt. 2900-3800 m.

C. colorata Wall. in Roxb., l. c. 101; Clarke in Hook. f., l. c. 440.

Annual herb, usually below scrubs on exposed slopes, apetalous form commoner. Flowers May-September, bluish in petalous form. Alt. 1700-2000 m.

C. cashmiriana Royle, Ill. Bot. Himal. 1:254, t. 62, f. 1, 1835; Clarke in Hook. f., l. c. 441.

Perennial herb, in crevices of rocky cliffs. Flowers July-September, Alt. 2000-2700 m.

C. latifolia L., Sp. Pl. 165, 1753; Clarke in Hook. f., l. c. 439.

Perennial herb, on shaded forested slopes. Flowers July-September, bluish purple. Alt. 2300-2800 m.

Codonopsis ovata Benth. ex Royle, l. c. 253, t. 69, f. 3; Clarke in Hook. f., l. c. 433; Coventry, Wild Fls. Kash. 1:55 pl. 27, 1923.

Perennial trailing or ascending herb, usually among scrubs. Flowers July-September, dirty blue. Alt. 3000-3800 m.

COMPOSITAE

Achillea millefolium L., Sp. Pl. 699, 1753; Hook. f., Fl. Brit. India 3:312, 1881.

Perennial herb, in wastelands and borders of cultivated fields. Flowers June-October, heads white. Alt. 1700-3100 m.

Vern. MOMUDNU, CHOPANDIGA

Arctium lappa L., Sp. Pl. 816, 1753; Hook. f., l. c. 359.

Tall perennial herb, in shaded wastelands. Flowers July-September, heads purplish. Alt. 1700-1900 m.

Artemisia indica Willd., Sp. Pl. 3:1846; 1803; Roxb., Fl. Ind. 3:419, 1832; DC., Prodr. 5:114, 1836; Wight, Ic. Pl. t. 1112.

A. vulgaris sensu Hook. f., l. c. 325 (pro parte).

Artemisia indica first named by Willdenow (1830), figured subsequently in the works of Roxburgh (1832), DeCandolle (1836), and Wight. Sir J.D. Hooker on examination of Indian specimens merged the species including *A. indica* Willd., *A. grata* Wall., etc. with the European *A. vulgaris* L. An examination of the

Indian specimens under *A. vulgaris*, revealed that in addition to other segregates of this species complex, since *A. vulgaris* L. does not grow in India, certain specimens identify with *A. indica* and are quite distinct. *A. indica* is distinguished by narrow lanceolate lobes of leaves being sparsely hairy or glabrescent below, heads numerous, pale yellowish green, ovate, ca 2 mm across.

Perennial herb, usually common under forests shade and in openings on humus rich soils. Flowers July-October. Alt. 1700-2200 m.

A. dubia Wall. in Besser, Tent. des Abrot. in Nouv. Mem. Nat. Mosc. 3:39, 1834; Stewart, Fl. West Pakistan 716, 1972.
A. vulgaris Hook. f., l. c. 325 (non L.), pro parte.

Perennial herb, usually on humus rich soils. Flowers August-October, yellowish black. Alt. 1900-2600 m.

A. parviflora Roxb., Fl. Ind. 3:420, 1832; Hook. f., l. c. 322.

Perennial herb, on dry open slopes. Flowers July-September, heads greenish. Alt. 1700-2300 m.

A. roxburghiana Bess., in Bull. Soc. Nat. Mosc. 9:57, 1836; Hook. f., l. c. 326.

Perennial herb, commoner on alpine slopes. Flowers July-September, heads purplish black. Alt. 2900-3800 m.

A. tournefortiana Reichb. Ic. Exot. 1:6, t. 5, 1824; Hook. f., l. c. 324.

Annual herb, usually in shaded wastelands. Flowers July-September, heads greenish. Alt. 1700-1900 m.

A. vestita Wall. ex DC., Prodr. 6:106, 1837; Hook. f., l. c. 322.

Perennial tufted herb, very common on dry slopes. Flowers September-October, heads yellow. Alt. 1700-2600 m.

Vern. TETHWAN

Anaphalis margaritacea Benth., subsp. *angustior* Kitamura in Mem. Coll. Sci. Kyoto Imp. Univ. 13:243, 1937; Gupta, Fl. Nainitalensis 185, 1968.

A. cinnamomea Clarke, Comp. Ind. 104, 1874; Hook. f., l. c. 281.

Perennial herb, on humus rich scrubby slopes. Flowers August-September, heads with white bracts, disc yellow. Alt. 1900-2400 m.

A. nepalensis (Spr.) Hand.-Maz., Symmb. Sin. 1099, 1936; Raizada, Indian For. 92(5) 301, 1966; Gupta, Fl. Nainitalensis 185, 1968.

A. nubigena DC., Prodr. 6:272, 1838.

Perennial herb, common in alpine pastures. Flowers May-August, white. Alt. 3000-3800 m.

Aster diplotophoides (DC.) Benth., Gen. Pl. 2:272; Hook. f., l. c. 251.

Perennial herb, in alpine pastures. Flowers July-September, ray blue. Alt. 3000-3800 m.

A. thomsonii Clarke, Comp. Ind. 48, 1876; Hook. f., l. c. 252.

Perennial herb, usually among scrubs. Flowers July-September, ray light blue. Alt. 2800-3300 m.

Bellis perennis L., Sp. Pl. 836, 1753; Ferris, Ill. Fl. Pac. States 4:304, 1960.

Perennial herb, usually locally common under *Platanus* shade. Flowers March-June, ray white or tinged purple. Alt. 1700 m.

Bidens biternata (Lour.) Merr. & Sherff., in Bot. Gaz. 88, 293, 1929; Maheshwari, Fl. Delhi 197, 1963.

B. pilosa auct. (non L.), Hook. f., l. c. 309.

Annual herb, usually in wastelands among scrubs, sometimes a weed of cultivation. Flowers August-October, heads yellow. Alt. 1700-1900 m.

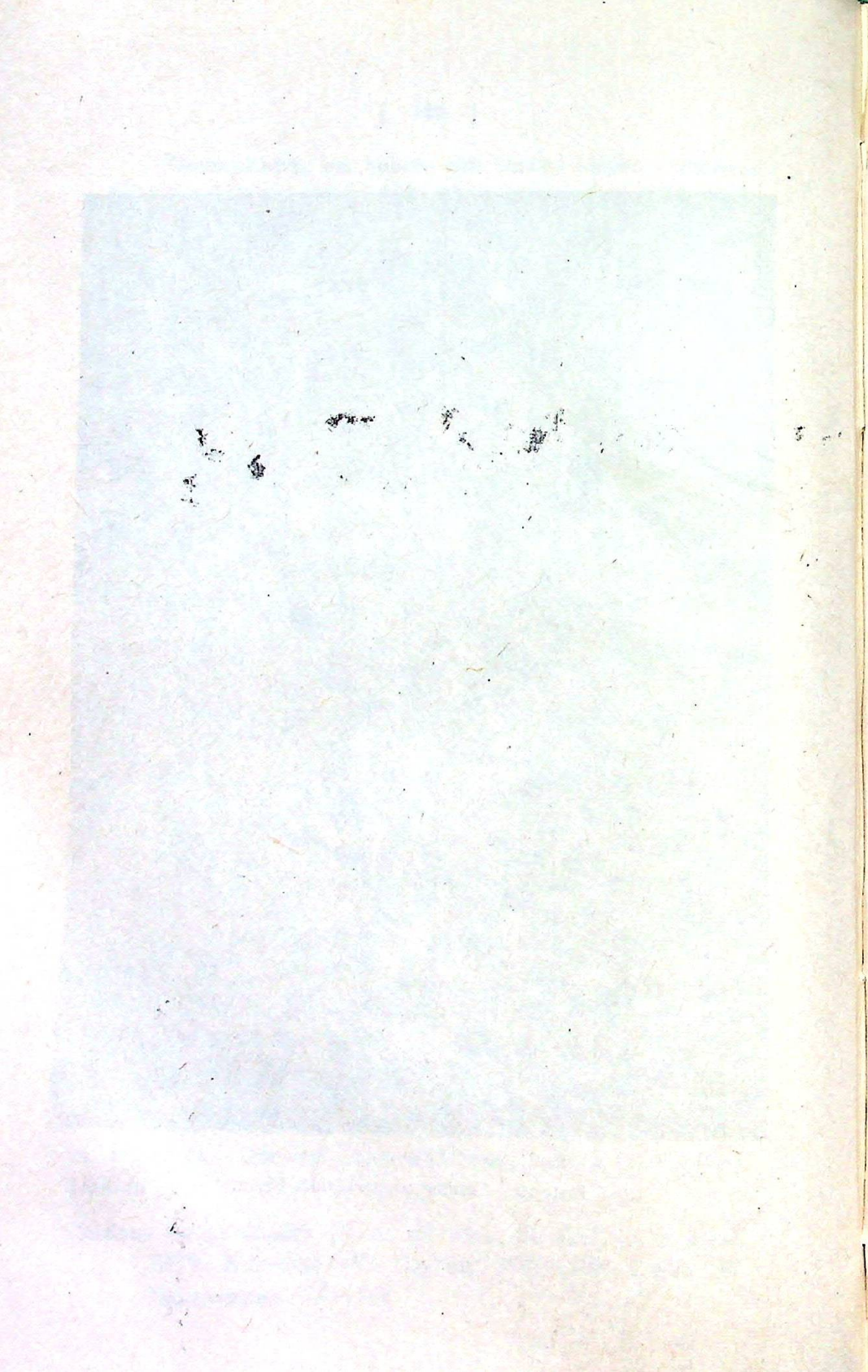
B. tripartita L., Sp. Pl. 831, 1753; Hook. f., l. c. 309.

Annual herb, usually along ditches, along rice fields, rarer in the area. Flowers August-October, yellow. Alt. 1700-1800 m.

Carduus onopordioides Fisch. ex Bieb., Fl. Taur. Cauc. 3:552, 1819; Kitamura, Fl. Afghan. 394, 1960; Gupta Fl. Nainitalensis 178, 1968.



Plate 10. *Carduus onopordioides* Fisch.



C. nutans Hook. f., l. c. 361 (non L.).

Biennial armed herb, in wastelands and open dry slopes. Flowers June-August, heads purplish. Alt. 1700-2000 m.

Carpesium abrotanoides L., Sp. Pl. 360, 1753; Hook. f., l. c. 301.

Annual herb, usually in shaded wastelands, also in forests in the ravine. Flowers July-November, heads yellow. Alt. 1700-2400 m.

C. cernuum L., Sp. Pl. 859, 1753; Hook. f., l. c. 300.

Annual herb, usually in shaded wastelands. Flowers July-November, heads yellow. Alt. 1700-2500 m.

Carthamus lanatus L., Sp. Pl. 830, 1753; Hook. f., l. c. 386.

Annual herb, usually in wastelands and along cultivated fields. Flowers June-July, heads yellow. Alt. 1700-1800 m.

Centaurea iberica Trev. ex Spreng., Syst. 3:406, 1826; Hook. f., l. c. 385.

Biennial herb, usually locally common in wastelands and on pastured slopes. Flowers July-September, purplish. Alt. 1700-1900 m.

Vern. KROTZ KOND

Chrysanthemum leucanthemum L., Sp. Pl. 888, 1753; Ferris, Ill. Fl. Pac. States 4:394, 1960.

Perennial herb, forming tufts, locally common near reservoir. Flowers May-June, disc yellow, ray white. Alt. 1700 m.

Cichorium intybus L., Sp. Pl. 813, 1753; Hook. f., l. c. 391.

Perennial herb, usually common along cultivated fields and in pastures. Flowers June-October, heads blue. Alt. 1700-2100 m.

Cicerbita cyanea (Don) Beauv. Bull. Soc. Bot. Gen. Ser. 2, 2:127, 1910.

Lactuca hastata DC., Prodr. 7:139, 1839; Hook. f., l. c. 407.

Sonchus cyanus Don, Prodr. Fl. Nep. 164, 1825.

Perennial herb, usually in crevices of moister rocks, humus rich soils. Flowers August-September, heads bluish. Alt. 2300-2800 m.

Cirsium arvense (L.) Scop., Fl. Carn. ed. 2, 2:126, 1772; Maheshwari, l. c. 201; Ferris, Ill. Fl. Pac. States 4:516, 1960.

Cnicus arvensis Hoffm., Deutschl. Fl. ed. 2, 1, 2:130; Hook.f., l. c. 322.

Perennial herb, usually in wastelands, rarer in the area. Flowers June-September, heads purplish. Alt. 1700 m.

C. falconeri (Hook.f.) Petrak, in Biblioth Bot. 78:9, 1912 in obs.;

Cnicus falconeri Hook.f., l. c. 363.

Tall perennial herb, along dry stream beds and alpine pastures. Flowers July-September, creamy. Alt. 2400-3300 m.

C. wallichii DC., Prodr. 6:643, 1838.

Cnicus wallichii (DC.) Hook.f., l. c. 363.

Biennial herb, usually in wastelands and in pastures, locally common. Flowers July-September, creamy. Alt. 1700-1800 m.

Cotula anthemoides L., Sp. Pl. 891, 1753; Hook.f., l. c. 316.

Annual herb, usually on house and wall tops and along roadsides, rarer in the area. Flowers May-July, heads yellow. Alt. 1700 m.

Vern. BOBUN

Crepis sancta (L.) Babc., subsp. *bifida* (Vis.) Thell ex Babc., in Univ. Calif. Publ. Bot. 22:236, f. 236-39, 1947; Kitamura, Fl. Afghan. 417, 1960.

Pterotheca falconeri Hook. f., l. c. 399.

Annual herb, usually common in wastelands and open scrubby slopes. Flowers April-June, heads yellow. Alt. 1700-2300 m.

Doronicum roylei DC., Prodr. 6:321, 1838; Hook. f., l. c. 332.

Perennial herb, in forest shade usually along mountain drains. Flowers June-August, heads yellow. Alt. 2400-2900 m.

Erigeron bellidioides Benth., Gen. Pl. 2:280, 1873; Hook.f., l. c. 256.

Perennial herb, on semishaded slopes. Flowers May-July, ray bluish purple. Alt. 1700-2100 m.

E. alpinus L., var. *khasiana* Hook.f., l. c. 255.

Biennial herb, usually on humus rich shaded slopes. Flowers June-September, ray light blue. Alt. 1800-2400 m.

E. bonariensis L., Sp. Pl. 863, 1753; Burt, Kew Bull. 371, 1948; Raizada, Indian For. 92 (5):310, 1966.

E. linifolius Willd., Sp. Pl. 3:1905, 1803; Hook.f., l. c. 254.

Annual herb, usually a weed of cultivation, also in wastelands. Flowers June-November, ray white. Alt. 1700-1900 m.

E. canadensis L., Sp. Pl. 863, 1753; Hook.f., l. c. 254.

Annual herb, usually a weed of cultivation, also in wastelands. Flowers June-October, ray white. Alt. 1700-1800 m.

Filago arvensis L., Sp. Pl. Add., 1753; Hook.f., l. c. 277.

Annual herb, locally common in dry rocky areas. Flowers April-May, whitish. Alt. 1800-2000 m.

F. spathulata Presl., Delic. Prag. 93, 1822; Kitamura. Fl. Afghan. 423, 1960.

F. germanica Hook.f., l. c. 277 (non L.).

Annual herb, usually locally common on dry open slopes. Flowers April-May, greyish white. Alt. 1700-2000 m.

Galinsoga parviflora Cav., Ic. Descr. 3:41, t. 281, 1794; Hook. f., l. c. 311.

Annual herb, usually in shaded wastelands, also in cultivated fields. Flowers June-October, disc yellow ray white. Alt. 1700-1900 m.

Garhadiolus minutissimus (Bunge) Kitamura, in Acta Phytotax. Geobot. 17:35, 1957; Kitamura, Fl. Afghan. 423, 1960.

Rhagadiolus hedyphnois Fisch. et Mey., Index Sem. Horti Petrop. 4:46, 1837 (non All., 1785).

Hedyphnois minutissima Bunge, Mem. Etr. Petersb. 7:372, 1847.

Annual herb, usually along roadsides and dry open slopes. Flowers April-June, heads yellow. Alt. 1700-1900 m.

Gnaphalium thomsonii Hook. f., l. c. 290.

Perennial herb, on humus rich scrubby slopes. Flowers April-June, heads pale yellow. Alt. 1900-2300 m.

Hieracium crocatum Fries, Symb. Hierac. 183; Hook. f., l. c. 400.

Perennial herb, usually in partially shaded humus rich soils. Flowers June-September, heads yellow. Alt. 1900-2400 m.

H. vulgatum Koch, Nov. Fl. Succ. ed. 2:258; Hook. f., l. c. 399.

Perennial herb, usually on deciduous forest slopes. Flowers May-June, heads yellow. Alt. 1700-2300 m.

Inula obtusiloba Kerner, in Ber. Nat. Verz. Innsbruck 1:111, 1870; Hook. f., l. c. 293.

Perennial herb, characteristically in the crevices of rocky cliffs. Flowers June-July, heads yellow. Alt. 1700-2000 m.

I. racemosa Hook. f., l. c. 292.

Tall perennial herb, in forest clearings. Flowers June-August, heads yellow. Alt. 1700-1800 m.

Vern. POSHKAR

I. royleana DC., Prodr. 5:464, 1836; Hook. f., l. c. 292.

Perennial herb, usually on exposed dry slopes. Flowers July-August, heads yellow. Alt. 3100-3600 m.

Vern. POSHKAR, ZAHELNIILKOHEE

Ixeris polycephala Cass., in Bull. Soc. Phil. 173, 1821.

Lactuca polycephala (Cass.) Benth., Gen. Pl. 2:526, 1873; Hook. f., l. c. 410.

Annual herb, usually along rice fields. Flowers April-May, heads yellow. Alt. 1700 m.

Jurinea macrocephala (DC.) Benth., Gen. Pl. 2:474, 1873; Hook. f., l. c. 378.

Perennial herb, on open alpine slopes. Flowers August-September, bluish purple. Alt. 3200-3800 m. Vern. DHUP

Lactuca dissecta Don, Prodr. Fl. Nep. 164, 1825; Hook. f., l. c. 405.

Annual herb, usually a weed of cultivation, also common on dry scrubby slopes. Flowers April-June, heads bluish. Alt. 1700-1900 m.

L. longifolia DC., Prodr. 7:135, 1839; Hook. f., l. c. 405.

Biennial herb, usually common in forests. Flowers June-September, heads blue. Alt. 2100-2800 m.

L. serriola L., Cent. Pl. 2:29, 1756; Ferris, Ill. Fl. Pac. States 4:592, 1960.

L. scariola L., Sp. Pl. 2 ed. 1119, 1763; Hook. f., l. c. 404.

Biennial herb, usually in wastelands and disturbed scrubby slopes. Flowers April-November, yellow. Alt. 1700-1900 m.

Lapsana communis L., Sp. Pl. 811, 1753; Hook. f., l. c. 392.

Annual herb, usually in forest shade. Flowers June-August, heads yellow. Alt. 1700-2400 m.

Leontopodium alpinum Cass., in Dict. Sc. Nat. 25:474; Hook. f., l. c. 279.

Perennial herb, in alpine pastures. Flowers May-August, heads yellowish white. Alt. 3100-3700 m.

Myriactis nepalensis Less., in Linnaea 6:128, t. 2, 1831; Hook. f., l. c. 247.

Annual herb, usually in damp shaded places in forests. Flowers July-October, ray white, disc yellow. Alt. 1700-2600 m.

Picris hieracoides L., Sp. Pl. 792, 1753; Hook. f., l. c. 393.

Annual herb, usually along pathways and along fields, sometimes in forest openings. Flowers July-September, heads yellow. Alt. 1700-2100 m.

Prenanthes brunoniana Wall. ex Hook. f., l. c. 411.

Perennial herb, often locally common in shaded forests. Flowers June-August, heads bluish. Alt. 2200-3100 m.

Saussurea albescence Hook.f., l. c. 374.

Perennial herb, common locally on dry scrubby slopes. Flowers July-August, heads bluish purple. Alt. 1900-2400 m.

S. atkinsoni Clarke, Comp. Ind. 224, 1876; Hook.f., l. c. 367.

Perennial herb, on alpine slopes. Flowers August-September, bluish purple. Alt. 3300-3900 m.

S. candolleana (DC.) Wall. ex Hook.f., Fl. Brit. India 3:372, 1881.

Perennial herb, usually among scrubs. Flowers August-September, bluish purple. Alt. 3100-3600 m.

S. heteromella (D. Don) Hand.-Mzt. Symb. Sin. 1154, 1936; Kitamura, Fl. Afghan. 439, 1960; Gupta, Fl. Nainitalensis 177, 1968.

Perennial herb, on dry rocky slopes. Flowers May, heads purplish. Alt. 1800-2000 m.

S. lappa Clarke, Comp. Ind. 233, 1876; Hook.f., l. c. 376.

Perennial herb, among dwarf scrubs. Flowers July-September, heads purplish. Alt. 3300-3700 m.

Vern. KOTH

Senecio chrysanthemoides DC., Prodr. 6:365, 1838; Hook.f., l. c. 339.

Perennial herb, common on borders of rich fields, in forests and on alpine slopes. Flowers June-October, heads yellow. Alt. 1700-3500 m.

S. jacquemontiana (Decne.) Benth., Gen. Pl. 2:449, 1873; Hook.f., l. c. 350.

Perennial herb, in forest shade usually along drains. Flowers July-August, heads yellow. Alt. 2400-3400 m.

Vern. KHALAR

S. vulgaris L., Sp. Pl. 867, 1753; Butcher, New Ill. Brit. Fl. 2:436, 1961; Singh, Bull. Bot. Surv. India 12(1-4):269, 1970.

Annual or biennial herb, a weed of cultivation, usually in orchards. Flowers October-June, heads yellow. Alt. 1700-1800 m.

Serratula pallida DC., Prodr. 6:670, 1838; Hook.f., l. c. 379.

Perennial herb, on open savana slopes often locally common. Flowers April-May, heads purplish. Alt. 1700-2000 m.

Siegesbeckia orientalis L., Sp. Pl. 900, 1753; Hook.f., l. c. 304.

Annual herb, common under forest shade. Flowers August-October, heads yellow. Alt. 1700-2000 m.

Solidago virga-aurea L., Sp. Pl. 880, 1753; Hook.f., l. c. 245.

Perennial herb, in forests and among scrubs. Flowers June-September, heads yellow. Alt. 1700-2300 m.

Sonchus asper (L.) Hill., Brit. Herb. 1:47, 1769; Hook.f., l. c. 414.

Annual herb, usually in wastelands. Flowers November-December, March-June, yellow. Alt. 1700-1800 m.

S. oleraceus L., Sp. Pl. 794, 1753; Hook.f., l. c. 414.

Annual herb, usually in wastelands. Flowers April-July, heads yellow. Alt. 1700-1900 m.

Tanacetum longifolium Wall. ex Clarke, Comp. Ind. 154, 1876; Hook.f., l. c. 320.

Perennial herb, common on alpine slopes. Flowers August-September, heads yellow. Alt. 3200-3900 m.

Taraxacum officinale Weber in Wigg., Prim. Fl. Hilst. 56, 1780; Hook. f., l. c. 401.

Perennial herb, common in forests and pastures. Flowers March-December, heads yellow. Alt. 1700-3100 m.

Vern. HANDH

Tussilago farfara L., Sp. Pl. 865, 1753; Hook. f., l. c. 330.

Perennial herb, on barren moister slopes, usually along streams. Flowers March, heads yellow. Alt. 1700-2100 m.

Xanthium strumarium L., Sp. Pl. 987, 1753; Hook. f., l. c. 303.

Annual herb, a weed of cultivation, rarer. Flowers August-October, heads greenish. Alt. 1700-1900 m.

SOLANACEAE

Datura stramonium L., Sp. Pl. 179, 1753; Clarke in Hook. f., Fl. Brit. India 4:242, 1883.

Annual herb, usually in wastelands, rarer. Flowers July-September, white. Alt. 1700-1800 m. Vern. DATUR

Hyoscyamus niger L., Sp. Pl. 179, 1753; Clarke in Hook. f., l. c. 244.

Annual or biennial herb, along pathways in ravine, rarer. Flowers yellowish brown, May-September. Alt. 1700-1800 m. Vern. BAZER BHANG

Solanum nigrum L., Sp. Pl. 186, 1753; Clarke in Hook. f., l. c. 229.

Annual herb, usually a weed of cultivation, often along pathways. Flowers May-September, white. Alt. 1700-2400 m. Vern. KACH MACH

CONVOLVULACEAE

Convolvulus arvensis L., Sp. Pl. 153, 1753; Clarke in Hook. f., Fl. Brit. India 4:219, 1883.

Perennial trailing or twinning herb, common in cultivated fields, wastelands and dry open slopes. Flowers May-October, white. Alt. 1700-2800 m.

Ipomoea eriocarpa R. Br., Prodr 434, 1810; Clarke in Hook. f., l. c. 204.

Annual herb, along pathways, rarer. Flowers July-October, pink. Alt. 1700 m.

SCROPHULARIACEAE

Leptorhabdos parviflora (Benth.) Benth. in DC., Prodr. 10:510, 1846; Pennel, Acad. Nat. Sci. Phil. Monogr. 5:28, 1943.

L. benthamiana Walp., Rep. Reg. Bot. 3:387, 1845; Hook. f., Fl. Brit. India 4:303, 1884.

Erect annual herb, usually common in open coniferous forests. Flowers August-October, pale pink. Alt. 1700-2500 m.

Lindernia pyxidaria L., Mant. Pl. 2:252, 1771; Pennel, l. c. 28.

Vandellia erecta Benth., Scroph. Ind. 36, 1835; Hook. f., l. c. 281.

Annual herb, common on borders of rice fields. Flowers August-September. Alt. 1700-1900 m.

Mazus delavayi Bonati in Bull., Herb. Boiss. Ser. 2, 8:530, 1908; Pennel, l. c. 34.

Annual herb, often locally common on borders of rice fields. Flowers April-May, white. Alt. 1700 m.

Pedicularis bicornuta Klotzsch ex Klotzsch & Garcke, Bot. Ergebn. Reise Waldermar 109, t. 61, 1862; Hook. f., l. c. 312; Coventry, Wild Fls. Kash. 3:93, pl. 47, 1930; Pennel, l. c. 145.

Perennial herb, on open slopes. Flowers July-September, yellow. Alt. 3300-3700 m.

P. pectinata Wall., Numer. List Spec. Ind. Mus. n. 420, 1829; Hook. f., l. c. 306; Coventry, Wild Fls. Kash. 3:91, pl. 46, 1930; Pennel, l. c. 132.

Perennial herb, usually along damp places in forests and pastures. Flowers July-October, light purple. Alt. 1700-3200 m.

P. punctata Decne., in Jacq. Voy. Bot. 117, pl. 122, 1844; Pennel, l. c. 154

P. siphonantha sensu Hook. f., l. c. 313 (pro parte); Coventry, l. c. 2:93, pl. 47, 1927.

Perennial herb, common along water drains. Flowers July-September, purple with white blotch. Alt. 2400-2900 m.

Scrophularia koelzii Pennel, l. c. 52, pl. 5A.

S. variegata Hook. f., l. c. 256 (non Bieb.).

Perennial herb, usually on dry rocky and savana slopes. Flowers May-July, yellowish white. Alt. 1800-2300 m.

S. polyantha Royle ex Benth., Scroph. Ind. 18, 1836; Hook. f., l. c. 255.

Perennial herb, usually in wastelands and along roadsides. Flowers June-October, greenish. Alt. 1700-1900 m.

Verbascum thapsus L., Sp. Pl. 177, 1753; Hook. f., l. c. 250;
Pennel, l. c. 40.

Biennial herb, usually on dry rocky areas and in wastelands.
Flowers May-November, yellow. Alt. 1700-2300 m.

Veronica arvensis L., Sp. Pl. 13, 1753; Hook. f., l. c. 296;
Pennel, l. c. 78.

Annual herb, usually a weed of cultivation, also in waste-
lands. Flowers April-June, blue. Alt. 1700-2200 m.

V. beccabunga L., Sp. Pl. 12, 1753; Hook. f., l. c. 293; Pennel,
l. c. 99.

Perennial herb, usually along water drains and borders of
rice fields. Flowers May-September, pink. Alt. 1700-1900 m.

V. biloba L., Mant. Pl. 172, 1771; Hook. f., l. c. 294; Pennel,
l. c. 81.

Annual herb, usually common in wastelands, disturbed
slopes and forests. Flowers April-July, blue. Alt. 1700-3200 m.

V. didyma L., Mant. Pl. 172, 1771; Pennel, l. c. 78.

V. agrestis Hook. f., l. c. 294 (non L.).

V. polita Fries, Novit. Fl. Suez. 63, 1869.

Annual herb, usually a weed of cultivation, also in waste-
lands and pastures. Flowers March-May, pale pink. Alt. 1700-
2300 m.

V. melissaefolia Poir., in Encycl. Meth. Bot. 8:526, 1808;
Pennel, l. c. 86.

V. laxa Benth., Scroph. Ind. 45, 1835; Hook. f., l. c.
295.

Perennial herb, usually among scrubs and in forests.
Flowers May-July, blue. Alt. 2000-3200 m.

V. persica Poir., l. c. 542; Hook. f., l. c. 294; Pennel, l. c. 78.

Annual spreading herb, usually common in wastelands and
cultivated areas. Flowers November-December, March-June,
blue. Alt. 1700-2600 m.

V. salina Schur., Enum. Pl. Transsylv. 492, 1866; Pennel,
l. c. 91.

V. anagallis sensu Hook. f., l. c. 293 (pro parte).

Perennial herb, usually in marshy places. Flowers May-September, pale purple. Alt. 1700-2200 m.

V. serphyllifolia L., Sp. Pl. 12, 1753; Hook. f., l. c. 296; Pennel, l. c. 77.

Perennial herb, usually on shaded moister ground. Flowers April-June, blue. Alt. 1700-2900 m.

V. stewartii Pennel, l. c. 81, pl. 7c.

Annual spreading or ascending herb, on humus rich disturbed soils, moister rocks. Flowers March-May, pale blue. Alt. 1700-2500 m.

ACANTHACEAE

Pteracanthus alatus (Wall. ex Nees) Bremk., Verh. Akad. Wetensch Akad. Naturk. 41(1):199, 1944; Gupta, Fl. Nainitalensis 257, 1968.

Strobilanthes alatus Nees in DC., Prodr. 11:194, 1847; Clarke in Hook. f., Fl. Brit. India 4:464, 1884.

Perennial herb, common along water drains. Flowers July-September, bluish purple, Alt. 1700-2300 m.

OROBANCHACEAE

Orobanche alba Steph. in Willd., Sp. Pl. 3:350; 1800; Kitamura, Fl. Afghan. 362, 1960.

O. epithymum DC., Fl. Fr. 3:490, 1815; Hook. f., Fl. Brit. India 4:326, 1884.

Perennial herb, usually parasitic on roots of *Origanum normale*. Flowers April-June, brown-purple. Alt. 1700-2000 m.

O. solmsii Clarke in Hook. f., l. c. 325.

Perennial herb, parasitic on roots of *Ferula jaeschkeana*. Flowers April-May, yellowish brown. Alt. 1800-1900 m.

LENTIBULARIACEAE

Utricularia aurea Lour., Fl. Cochinch. 26, 1970; Baker, Fl. Java 2:517, 1965; Raizada, Indian For. 92 (5): 453, 1966.

U. flexuosa Vahl. Enum. 198, 1804; Clarke in Hook. f., l. c. 329.

Aquatic floating herb, usually in rice swamps. Flowers June-September, yellow. Alt. 1700 m.

GERANIACEAE

Erodium cicutarium (L.) L'Herit, ex Aiton. Hort. Kew 1 ed., 2:414, 1789; Edgew. et Hook. f., Fl. Brit. India 1:434, 1874.

Annual herb, usually a weed of cultivation, fairly common in wastelands and open disturbed scrubby slopes. Flowers March-July, pink. Alt. 1700-2200 m.

Geranium collinum Steph. ex Willd., Sp. Pl. 3:705, 1800; Edgew. et Hook. f., l. c. 429.

Perennial herb, usually in deciduous forests. Flowers April-May, purplish violet. Alt. 1700-2000 m.

G. tuberaria Camb. in Jacq., Voy. Bot. 33, t. 34, 1844; Hook. f., l. c. 431.

Perennial herb, usually shaded in forests. Flowers April-June, bluish pink. Alt. 1800-2500 m.

G. lucidum L., Sp. Pl. 682, 1753; Edgew. et Hook. f., l. c. 433.

Annual herb, locally common in crevices of shaded rocks, moist humus rich soils. Flowers April-June, purple. Alt. 1900-2600 m.

G. nepalensis Sweet, Geran. l., t. 12, 1820; Edgew. et Hook. f., l. c. 430.

Perennial herb, locally common in moister shaded places. Flowers May-November, pale pink. Alt. 1700-2300 m.

G. pratense L., Sp. Pl. 681, 1753; Edgew. et Hook. f., l. c. 429.

Perennial herb, usually on semishaded scrubby slopes and in forests. Flowers April-May, bluish pink. Alt. 1700-2800 m.

G. pusillum Linn. f., Sp. Geran. 27, 1759; Edgew. et Hook. f., l. c. 432.

Annual herb, usually in wastelands and disturbed slopes. Flowers April-May, bluish purple. Alt. 1700-1900 m.

G. rotundifolia L., Sp. Pl. 683, 1753; Edgew. et Hook. f., l. c. 432.

Annual herb, fairly common on open scrubby slopes, deciduous forests and in wastelands. Flowers April-June, purple. Alt. 1700-2100 m.

G. wallichianum Don ex Sweet, Geran. l. t. 90, 1821; Edgew. et Hook. f., l. c. 430; Coventry, Wild Fls. Kash. 1:29, pl. 15, 1923.

Perennial herb, usually common in forests. Flowers June-September, purplish violet. Alt. 1900-2900 m.

OXALIDACEAE

Oxalis corniculata L., Sp. Pl. 433, 1753; Edgew. et Hook. f., l. c. 436.

Perennial herb, usually in shaded areas. Flowers May-July, yellow. Alt. 1700-1900 m.

BALSAMINACEAE

Impatiens bicolor Royle, Ill. Bot. Himal. 151, 1835; Raizada, Indian For. 92(5) : 312, 1966.

I. amphorata Edgew., Trans. Linn. Soc. 20:39, 1846; Hook. f., Fl. Brit. India 1:485, 1874.

Annual herb, usually in damp places. Flowers July-Sept., yellowish. Alt. 1700-1900 m.

I. brachycentra Kar. & Kir., Bull. Soc. Nat. Mosc. 15:174, 1842; Hook. f., l. c. 481.

Annual herb, usually common on humus rich slopes, along pathways, moist rocks. Flowers May-October, white. Alt. 1700-2700 m.

I. cristata Wall. in Roxb., Fl. Ind. ed. 1, 1:456, 1820; Raizada, Indian For. 92(5) : 312, 1966.

I. scabrida Hook. f., l. c. 472.

Annual herb, usually on scrubby slopes. Flowers August-September, golden yellow. Alt. 1900-2600 m.

I. edgeworthii Hook. f., l. c. 476.

Annual herb, usually in forest openings in ditches, near

water drains. Flowers July-September, yellow. Alt. 1700-2200 m.

I. gigantea Edgew., Trans. Linn. Soc. 20:38, 1846; Rao, Rec. Bot. Surv. India 18(2) : 23, 1960.

I. sulcata Wall. ex Hook. f., Thoms., Journ. Linn. Soc. 4:129.

Tall annual herb, common in forests and on humus rich soils. Flowers July-September, purple. Alt. 1700-2000 m.

I. glandulifera Royle, Ill. Bot. Himal. 151, t. 95, 1834; Sprague, Kew Bull. 386, 1933; Hutchinson, Fam. Fl. Plants 1:499, 1959.

I. roylei Walp., Rep. 1:475, 1845; Hook. f., l. c. 468.

Tall annual herb, usually locally common in damp shaded places. Flowers July-September, purple. Alt. 1700-2100 m.

I. thomsonii Hook. f., Journ. Linn. Soc. 4:128; Hook. f., Fl. Brit. India 1:469, 1874.

Annual herb, usually on humus rich slopes. Flowers June-September, purple. Alt. 1800-2900 m.

CUSCUTACEAE

Cuscuta brevistyla A. Br. ex Rich., Tent. Fl. Abyss. 2:79, 1850; Kitamura, Fl. Afghan. 312, 1960.

C. planiflora Clarke in Hook. f., Fl. Brit. India 4:227, 1883.

Parasitic twinning annual, usually parasitic on *Isodon rugosus* and *Origanum normale*. Flowers May-August, whitish. Alt. 1700-2100 m.

C. reflexa Roxb., Pl. Corom. 2, 3:104, 1798; Clarke in Hook. f., l. c. 225.

Parasitic twinner, usually parasitic on scrubs like *Desmodium tiliaefolium*, *Viburnum grandiflorum* and *Rubus ulmifolius*. Flowers June-September, pale purplish. Alt. 1700-2900 m.

BORAGINACEAE

Asperugo procumbens L., Sp. Pl. 139, 1753; Clarke in Hook. f., Fl. Brit. India 4:167, 1883.

Spreading perennial herb, usually a weed in orchards, some

times among scrubs. Flowers April-May, bluish. Alt. 1700-1800 m.

Cynoglossum lanceolatum Forsk, Fl. Aeg. 41, 1775; Brand in Engl., Das Pflanzenreich Heft 78:137, 1921.

C. micranthum Desf., Cat. Hort. Par. 220, 1804; Clarke in Hook. f., l. c. 156.

Biennial herb, usually in deciduous forests. Flowers July-August, white with blue scales. Alt. 1700-1900 m.

C. glochidiatum Benth. in Royle, Ill. Bot. Himal. 306, 1836; Kitamura, Fl. Afghan. 314, 1960.

C. denticulatum A. DC., Prodr. 10:150, 1846; Clarke, in Hook. f., l. c. 157.

Perennial herb, usually under forest shade. Flowers July-October, blue. Alt. 1700-2700 m.

Eritrichium strictum Decne. in Jacq., Voy. Bot. 125, 1844; Clarke in Hook. f., l. c. 164.

Tufted perennial herb, usually among scrubs and rocky alpine slopes. Flowers July-September, pale blue. Alt. 3200-3800 m.

Hackelia glochidiata (Wall.) Brand in Engl., Das Pflanzenreich Heft 97:119, 1931; Kitamura, Fl. Afghan. 316, 1960.

Paracaryum glochidiatum Benth. & Hook. f., Gen. Pl. 2:850, 1876.

Perennial herb, usually among scrubs and stream side vegetation. Flowers August-September, blue. Alt. 2800-3400 m.

Lindelofia longiflora (Benth.) Baillon, Hist. Plant 3:379, 1890, var. *falconeri* (Clarke) Brand in Engl., l. c. 85.

L. spectabilis Lehm., in Linnaea 24:216; Clarke in Hook. f., l. c. 159.

Perennial herb, on rocky open slopes. Flowers July-September, blue. Alt. 2800-3400 m.

Lithospermum arvense L., Sp. Pl. 132, 1753; Clarke in Hook. f., 174.

Annual herb, usually a weed of cultivation, also on dry scrubby slopes. Flowers April-June, white. Alt. 1700-2400 m.

L. officinale L., Sp. Pl. 132, 1753; Clarke in Hook. f., l. c. 175.

Perennial herb, usually on scrubby and savana slopes. Flowers April-May, white. Alt. 1700-2400 m.

Lycopsis orientalis L., Sp. Pl. 134, 1753; Pop., Fl. URSS 19: 178, 1882; Clarke in Hook., f., l. c. 169.

Annual herb, usually a weed of cultivation also on dry disturbed slopes and in wastelands. Flowers March-May, blue, pink and white. Alt. 1700-2000 m.

Macrotomia benthami DC., Prodr. 10:26, 1846; Clarke in Hook. f., l. c. 177; Coventry, Wild Fls. Kash. 1:75, pl. 37, 1923.

Perennial herb, on alpine slopes. Flowers July-August, purplish brown. Alt. 3600-4000 m. Vern. KAAH ZABAN

Mertensia echioides Benth., Gen. Pl. 2:857, 1876; Clarke in Hook. f., l. c. 170.

Perennial herb, usually on open rocky slopes. Flowers July-September, blue. Alt. 2900-3600 m.

M. exserta Johnston, Journ. Arn. Arb. 37: 305, 1956; Kitamura, Fl. Afghan. 130, 1960.

Moltkia parviflora (Decne.) Clarke in Hook. f., l. c. 171.

Perennial herb, usually on humus rich soils. Flowers April-May, dirty white. Alt. 1700-2300 m.

Myosotis caespitosa Schultz., Fl. Starb. 2:11; Clarke in Hook. f., l. c. 173.

Perennial aquatic herb, usually in rice fields, marshy places. Flowers May-November, blue. Alt. 1700-2000 m.

M. micrantha Pall. ex Lehm., in Deue Denk. de Nat. Ges. Halle 3, 2:24, 1817; Kitamura, Fl. Afghan. 322, 1960.

M. stricta Link in Roem. et Schult., Syst. 4:104, 1819; Clarke in Hook. f., l. c. 174.

Annual herb, usually in shaded places, disturbed scrubby slopes. Flowers May-July, blue. Alt. 1700-2500 m.

M. sylvatica Hoffm., Deutsch. Fl. 1:85, 1791; Clarke in Hook. f., l. c. 173.

Annual herb, usually in forests, along water drains. Flowers May-August, blue. Alt. 2100-2800 m.

Onosoma hispidum Wall., ex Ledeb., Fl. Ross. 3:125, 1847; Rao, Bull. Bot. Surv. India 2(1-4): 409, 1960.

O. echoides Clarke in Hook. f., l. c. 178 (non L.).

Perennial herb, on dry rocky and savana slopes. Flowers April-May, yellow. Alt. 1700-2000 m.

Paracaryum microcarpum Boiss., Diagn. Ser. 2, 3:139, 1856; Clarke in Hook. f., l. c. 162.

Perennial herb, usually on scrubby slopes along pathways, rarer. Flowers June-September, bluish. Alt. 2000-2400 m.

Rochelia stellulata Reichb., Iconogr. 2:13, t. 123; Clarke in Hook. f., l. c. 166.

Annual herb, on disturbed scrubby slopes. Flowers April-May, blue. Alt. 1700-2000 m.

Solenanthus circinatus Ledeb., Fl. Alt. 1:194, 1826; Clarke in Hook. f., l. c. 160.

Perennial herb, often locally common in deciduous forests, on moist shaded rocks. Flowers April-May. Alt. 1700-2400 m.

LABIATAE

Ajuga remota Benth. in Wall., Pl. As. Rar. 1:59, 1830; Gupta, Fl. Nainitalensis 273, 1968.

A. bracteosa Wall. ex Benth., l. c. 59; Hook. f., Fl. Brit. India 4:702, 1885.

Perennial herb, on rocky slopes. Flowers April-October, pale lilac. Alt. 1700-2100 m.

Clinopodium umbrosum (M. Bieb.) C. Koch., in Linnaea 21:673, 1848; Kitamura, Fl. Afghan. 328, 1960.

Calamintha umbrosa Fisch. et Mey. Ind. Sem. 6:6, 1840; Hook. f., l. c. 650 (pro parte).

Perennial herb, usually in forest shade, damp places. Flowers June-September, pink. Alt. 1700-2500 m.

C. vulgare L., Sp. Pl. 587, 1753; Kitamura, l. c. 328.

Calamintha clinopodium Benth. ex DC., Prodr. 12:233, 1848; Hook. f., l. c. 660.

Perennial herb, usually among scrubs, on dry scrubby and savana slopes. Flowers May-July, purple. Alt. 1700-2200 m.

Elscholtzia fruticosa (D. Don) Rehder, in Sargent Fl. Wils. 3:381, 1916; Rehder, Man. Cult. Trees and Shrubs 812, 1940; Raizada, Indian For. 92(5) : 309, 1966.

E. polystachya Benth., Lab. Gen. et Sp. 161, 1832; Hook. f., l. c. 643.

Deciduous shrub, usually in forest openings, among scrubs. Flowers August-September, creamy. Alt. 2200-2700 m.

E. patrini (Lep.) Garcke, Ill. Fl. Deutsch. 307, 1865; Raizada, l. c. 309.

E. cristata Willd. in Roem. et Listeri, Mag. 415, 1790; Hook. f., l. c. 645.

Annual herb, usually in forests along pathways. Flowers July-September, pink. Alt. 2200-2700 m.

Isodon rugosus (Wall.) Codd, Taxon 17(2) : 239, 1968.

I. plectranthoides Schrad. ex Kudo Lab. Sino-Jap. 1929; Kitamura l. c. 330; Srinivasan and Agarwal, Bull. Bot. Surv. India 5(1) : 83, 1963.

Plectranthus rugosus Wall. Pl. As. Rar. 2:17, 1831; Hook. f., l. c. 620.

Deciduous shrub, abundant on scrubby and savana slopes. Flowers August-October, bluish. Alt. 1700-2700 m.

Vern. SLOI

Lamium album L., Sp. Pl. 579, 1753; Hook. f., l. c. 679.

Perennial herb, usually among scrubs on humus rich soils. Flowers May-July, white. Alt. 2100-2600 m.

L. amplexicaule L., Sp. Pl. 579, 1753; Hook. f., l. c. 679.

Annual herb, usually along dry stony walls, rarer. Flowers April-June, purple. Alt. 1700-1800 m.

Leonurus cardiaca L., Sp. Pl. 584, 1753; Hook. f., l. c. 678.

Perennial herb, usually locally common on humus rich soils. Flowers June-August, whitish. Alt. 1900-2700 m.

Lycopus europaeus L., Sp. Pl. 21, 1753; Hook. f., l. c. 648.

Perennial herb, usually along watery situations. Flowers July-September, white. Alt. 1700-2000 m.

Marrubium vulgare L., Sp. Pl. 583, 1753; Hook. f., l. c. 671.

Perennial herb, usually in wastelands and pastures. Flowers May-June, November-December, white. Alt. 1700-1900 m.

Vern. TRAPAR

Mentha longifolia Huds. var. *royleana* (Benth.) Raizada, Indian For. 92(5) : 317, 1966.

M. sylvestris L. var. *royleana* (Benth.) Hook. f., l. c. 647.

M. royleana Benth. in Wall., Pl. As. Rar. 1:29, 1831.

Perennial herb, usually common along water channels. Flowers July-October, pale pink. Alt. 1700-2400 m. Vern. VEN

M. piperita L., Sp. Pl. 576, 1753; Butcher, New Ill. Brit. Fl. 2:309, 1961.

Perennial herb, growing along borders of rice fields, locally at a few places. Flowers July-August, blue purple. Alt. 1700 m.

Vern. PUDIN

Micromeria biflora (Ham.) Benth. Lab. Gen. et Sp. 378, 1834; Hook. f., l. c. 650.

Perennial herb, on dry slopes usually along pathways. Flowers June-August, white. Alt. 1800-2300 m.

Nepeta cataria L., Sp. Pl. 570, 1753; Hook. f., l. c. 662.

Perennial foetid herb, usually in semishaded wastelands. Flowers June-August, white. Alt. 1700-1900 m.

Vern. GANDH SOI

N. erecta (Royle) Benth., l. c. 482; Hook. f., l. c. 663.

Dracocephalum erectum Royle ex Benth. in Hook., Bot. Misc. 3:380, 1833.

Perennial herb, usually on disturbed humus rich soils. Flowers June-July, blue. Alt. 2200-2400 m.

N. govaniana Benth., l. c. 482; Hook. f., l. c. 663.

Perennial herb, on humus rich soils, usually along stream-

side vegetation. Flowers July-September, yellow. Alt. 2100-2700 m.

N. laevigata (Don) Hand.-Mzt., Symb. Sin. 4:916, 1936; Kitamura, Fl. Afghan. 339, 1960.

N. spicata Benth. in Wall., l. c. 64; Hook f., l. c. 659.

Betonea laevigata Don, Prodr. Fl. Nep. 110, 1825.

Perennial herb, quite common along scrubs in forest openings. Flowers August-October, bluish purple. Alt. 1700-2200 m.

N. linearis Royle ex Benth. in Hook., Bot. Misc. 3:377, 1833; Hook. f., l. c. 657.

Perennial herb, usually on humus rich savana slopes. Flowers May-June, bluish purple. Alt. 1800-2400 m.

N. raphanorhiza Benth., Lab. Gen. et Sp. 734, 1835; Hook. f., l. c. 659.

Perennial herb, often locally common on open dry slopes. Flowers April-May, purple. Alt. 1700-2000 m.

N. salviaefolia Royle ex Benth. in Hook., l. c. 397; Hook. f., l. c. 664.

Perennial herb, characteristically in dry rocky areas, rarer. Flowers July-September, pale lilac. Alt. 1700-2100 m.

Origanum normale Don, Prodr. Fl. Nep. 113, 1825; Benth in Wall., Pl. As. Rar. 1:31, 1831; Benth., Lab. Gen. et Sp. 335, 1834; Benth. in DC., Prodr. 12:193, 1848.

O. vulgare var. *viride* Boiss., Fl. Orient. 661, 1879.

O. vulgare Hook. f., l. c. 648 (Pro parte).

O. normale is fairly common on dry open, scrubby and savana slopes. Flowers June-September, white. Alt. 1700-2700 m (in Dachhigam). Vern. MARZANJOSH, WAN BABUR

Phlomis bracteosa Royle ex Benth. in Hook., Bot. Misc. 3:383, 1833; Hook. f., l. c. 702.

Perennial herb, on rocky slopes. Flowers July-September, dark lilac. Alt. 3100-3700 m.

P. spectabilis Falc. ex Benth. in DC., Prodr. 12:542, 1848; Hook. f., l. c. 692.

Tall perennial herb, usually locally common near ridges and dry rocky areas. Flowers May-July, dark lilac. Alt. 1700-2000 m.
Vern. PHAGHURN

Prunella vulgaris L., Sp. Pl. 600, 1753; Hook. f., l. c. 670; Nelson, Bull. Torrey Bot. Club 90(1) : 29-32, 1963.

Perennial herb, common in shaded forests, along borders of rice fields. Flowers June-August, dark purple. Alt. 1700-8100 m.
Vern. KAL VEOTH

Salvia asperata Falc. ex Benth. in DC., l. c. 282; Hook. f., l. c. 654.

Perennial herb, usually in forest openings, rare. Flowers May-July, white. Alt. 1700-2200 m.

S. glutinosa L. subsp. *nubicola* (Wall. ex Sweet) Murata in Kitamura, Fl. Afghan. Add. Corr. 135, 1966.
S. glutinosa Hook. f., l. c. 653 (non L.).

Perennial herb, usually on savana slopes and among scrubs. Flowers July-September, yellow. Alt. 1700-2500 m.

S. hians Royle in Hook., Bot. Misc. 3:373, 1833; Hook. f., l. c. 653.

Perennial herb, on open slopes. Flowers July-August, dark lilac. Alt. 3200-3800 m.

S. moorcroftiana Wall. ex Benth. in Wall., Pl. As. Rar. 1:67, 1830; Hook. f., l. c. 654.

Perennial herb, usually common in wastelands, also on dry slopes. Flowers May-July, pale lilac. Alt. 1700-2300 m.

Vern. SHOLAR

Stachys floccosa Benth., Lab. Gen. et Sp. 739, 1835; Hook. f. l. c. 675.

Perennial herb, along pathways, rarer. Flowers July-Sept., bluish purple. Alt. 1700-1900 m.

S. sericea Wall., l. c. 64; Hook. f., l. c. 675.

Perennial herb, usually on open slopes, forest openings. Flowers July-September, bluish purple. Alt. 2500-3300 m.

S. sylvatica L., Sp. Pl. 580, 1753; Hook. f., l. c. 676.

Perennial herb, on humus rich slopes. Flowers June-August, pink. Alt. 1700-2500 m.

Thymus serpyllum L. subsp. *quinquecostatus* (Celsk.) Kitamura, Fauna & Flora Nep. Himal. 216, f. 27, 1955.

T. serpyllum sensu Hook. f., l. c. 649 (non L.).

Creeping undershrub, common on dry rocky slopes, less so in scrubby areas. Flowers May-November, purplish. Alt. 1700-3100 m. Vern. JAVEN

ALISMATACEAE

Alisma plantago-aquatica L., Sp. Pl. 342, 1753; Hook. f., Fl. Brit. India 6:559, 1893.

Perennial herb, usually in shallow water ponds, swampy rice fields. Flowers June-September, white. Alt. 1700-1800 m.

Sagittaria sagitifolia L., Sp. 993, 1753; Hook. f., l. c. 561.

Perennial herb, usually in shallow water ponds, swampy rice fields. Flowers June-September, white. Alt. 1700-1800 m.

POTAMOGETONACEAE

Potamogeton crispus L., Sp. Pl. 126, 1753; Hook. f., Fl. Brit. India 6:565, 1893.

Submerged aquatic herb, perennial, in channels. Flowers August-October, greenish. Alt. 1700 m.

P. pectinatus L. Sp. Pl. 127, 1753; Hook. f., l. c. 567.

Aquatic perennial, in ponds. Flowers July-October, greenish. Alt. 1700 m.

ERIOCAULACEAE

Eriocaulon sieboldianum Sieb. & Zucc. ex Steud., Syn. Pl. Cyp. 272; Hook. f., Fl. Brit. India 6:577, 1893.

Annual herb, usually locally common in rice fields. Flowers August-September, silvery. Alt. 1700-1900 m.

LILIACEAE

Asparagus filicinus Buch.-Ham. ex D. Don, Fl. Nep. 49, 1825; Hook. f., Fl. Brit. India 6:314, 1892.

Perennial herb, usually on loose humus rich soils in forests. Flowers April-May, white. Alt. 1700-2700 m.

Colchicum luteum Baker, Gard. Chron. 34, 1874; Hook. f., l. c. 356.

Perennial herb, very common on open slopes, less so in forests. Flowers February-March, yellow. Alt. 1700-2400 m.

Vern. VIR KEOM

Eremurus himalaicus Baker, in Journ. Linn. Soc. 15:283, 1876; Hook. f., l. c. 332.

Perennial herb, on humus rich soils. Flowers May-June, white. Alt. 1900-2400 m.

Vern. WALUN

Fritillaria imperialis L., Sp. Pl. 303, 1753; Hook. f., l. c. 353.

Perennial herb, very common on humus rich soils usually in gulleys and shaded sides of large rocks. Flowers March-April, brick red. Alt. 1800-2600 m.

Vern. PRENIK

Gagea dschungarica Regel, in Act. Hort. Petrop. 6:513, 1879; Gross, Fl. URSS 6:75, t. 6, f. 8, 1935; Javeid, Fl. Sgr. 2:773, 1970.

Perennial herb, often locally common under *Platanus* shade, rarer elsewhere. Flowers March, yellow. Alt. 1700-2000 m.

G. elegans Wall. ex Don. in Royle, Ill. Bot. Himal. 388, t. 95, f. 2, 1840; Sprague, Kew Bull. 386, 1933; Javeid, Fl. Sgr. 2:770, 1970.

G. lutea Hook. f., l. c. 385 (non L.).

Perennial herb, often locally common under *Platanus* shade, moist pastures. Flowers March-April with altitude, yellow. Alt. 1700-2300 m.

G. gageoides (Zucc.) Vved., Fl. Turkm. 1, 2:261; Kitamura, Fl. Afghan. 72, 1960.

G. persica sensu Hook.f., l.c. 356 (Pro parte).

Perennial herb, usually in moist pastures. Flowers March-April, yellow. Alt. 1700-2500 m.

G. kashmirensis Turril, Kew Bull. 77, 1928; Blatter, Beaut. Fls. Kash. 2:171, 1928.

Perennial herb, usually among scrubs, in forests and rock crevices. Flowers March, yellow. Alt. 1700-2600 m.

G. stipitata Marckle ex Bunge, Mem. Sav. Etrang. Petersb. 7:512, 1851; Kitamura l. c. 73.

Perennial herb, usually in drier places, also in forests, and under *Platanus* shade. Flowers April, white. Alt. 1700-1900 m.

Hemerocallis fulva L., Sp. Pl. 2 ed., 462, 1762; Hook. f., l. c. 326.

Perennial herb, among scrubs in the ravine, usually along drains. Flowers June-July, brick red. Alt. 1700-1800 m.

Polygonatum multiflorum (L.) All., Fl. Pedem. 1:131, 1785; Hook. f., l. c. 319.

Perennial herb, usually common on *Parrotiopsis* dominated slopes. Flowers April-May, greenish white. Alt. 1800-2600 m.

P. verticellatum All., l. c. 131; Hook. f., l. c. 321.

Perennial herb, on humus rich soils usually near large moister rocks. Flowers May-June, greenish yellow. Alt. 1900-2700 m.

Tulipa clusiana DC., var. *stellata* Regel, Enum. Tulip. 54; Hoog et al., Royal Gen. Bulbgr. Soc. 47, 1963.

T. stellata Hook., Bot. Mag. t. 2762; Hook. f., l. c. 359.

Perennial herb, often locally common in forest openings, dry savana slopes. Flowers April-May, purplish outside, whitish within. Alt. 1700-2300 m.

PONTEDERIAACEAE

Monochoria vaginalis Presl., Reliq. Hoenk. 2:128; Hook. f., l. c. 363.

Perennial herb, usually in rice swamps, rarer. Flowers August-September, blue. Alt. 1700 m.

SMILACACEAE

Smilax vaginata Decne., in Jacq. Voy. Bot. 169, t. 169, 1844; Hook. f., Fl. Brit. India 6:305, 1892.

Deciduous undershrub, among scrubs and in forests on humus rich soils. Flowers April-May, purple. Alt. 1700-2600 m.
Vern. THIR

ARACEAE

Arum jacquemontianum Blume, Rumphia 1:118; Hook.f., Fl. Brit. India 6:509, 1893.

Perennial herb, on scrubby slopes and humus rich soils, rarer. Flowers April-May, spathe purplish green. Alt. 1800-2500 m.

Arisaema flavum Schott, Prodr. 40; Hook. f., l. c. 503.

Perennial herb, often locally common on humus rich soils, among scrubs. Flowers June-September, spathe purplish. Alt. 1800-2300 m.

A. utile Hook.f. ex Engl. in DC., Monogr. Phan. 2:544; Hook.f., l. c. 499.

Perennial herb, usually in deciduous forests, humus rich slopes. Flowers June-August, spathe reddish. Alt. 2500-2900 m.

LEMNACEAE

Lemna minor L., Sp. Pl. 970, 1753; Hook.f., Fl. Brit. India 6:556, 1893.

Floating thalloid herb, usually in rice swamps, ponds. Flowers July-September, greenish. Alt. 1700 m.

Spirodella polyrhiza (L.) Schleid., in Linnæa 13:392, 1839; Maheshwari, Fl. Delhi 346, 1963.

Lemna polyrhiza L., Sp. Pl. 970, 1753; Hook.f., l. c. 559.

Floating thalloid herb, in rice swamps and ponds. Flowers July-September, greenish. Alt. 1700 m.

TYPHACEAE

Typha angustata Bory & Chaub, Exp. Sc. Mor. Bot. 1:338, 1832; Hook.f., Fl. Brit. India 6:489, 1893.

Perennial herb, in ponds. Flowers May-June, reddish brown.
Vern. PETZ
Alt. 1700 m.

SPARGANIACEAE

Sparganium ramosum Huds., Fl. Angl. 401, 1762; Hook.f., Fl. Brit. India 6:490, 1893.

Perennial herb, usually in ditches along rice fields, in shallow waters. Flowers September-October, brownish. Alt. 1700 m.

AMARYLLIDACEAE

Allium atropurpureum Waldst. & Kit., Pl. Rar. Hung. 1:16, t. 17, 1802; Hook.f., Fl. Brit. India 6:344, 1892.

Perennial herb, usually locally common on shaded humus rich soils along rocky cliffs. Flowers April-May, purple. Alt. 1900-2200 m.

Vern. WAN PRAAN

A. consanguineum Kunth, Enum. 4:431, 1843; Hook.f., l. c. 340.

Perennial herb, on moist rocky cliffs. Flowers August-September, yellow. Alt. 2300-2500 m.

Vern. RUHAN HAAK

IRIDACEAE

Iris aurea Lindl., Bot. Reg. 33, t. 59; Hook.f., Fl. Brit. India 6:273, 1892.

Perennial herb, usually forming patches in graveyards, planted. Flowers April-May, yellow. Alt. 1700-1800 m.

I. ensata Thunb., Trans. Linn. Soc. 2:328, 1794; Hook. f., l. c. 272.

Perennial herb, isolated patches in the ravine, rarer. Flowers March-April, lighter blue. Alt. 1700-1800 m.

Vern. KRISHM

I. hookeriana Foster in Gard. Chron. 1:611, 1887; Hook. f., l. c. 275; Coventry, Wild Fls. Kash. 3:99, pl. 50, 1930.

Perennial herb, on open slopes. Flowers May-July, with altitude, lilac. Alt. 2400-3100 m.

I. kasbmiriana Baker, Gard. Chron. 2:744, 1877; Hook.f., l. c. 275.

Perennial herb, growing along with *I. nepalensis* in graveyards. Flowers April-May, white, fragrant. Alt. 1700-1800 m.

Vern. MAZAR MOND

I. nepalensis Wall. ex Lindl., in Bot. Reg. t. 818, 1824; Royle, Ill. Bot. Himal. 372, t. 90, f. 2, 1839.

I. deflexa Knowls & Wetc., Flor. Cab. 2:19, t. 57.

Perennial herb, usually common in graveyards, few escapes in the ravine. Flowers April-May, lilac. Alt. 1700-1900 m.

Vern. MAZAR MOND, SOSAN

I. spuria L. var. *notha* Baker; Coventry, Wild Fls. Kash. 3:97, pl. 49, 1930.

Perennial herb, usually locally common in graveyards. Flowers April-May, blue. Alt. 1700 m.

DIOSCOREACEAE

Dioscorea deltoidea Wall. ex Kunth, Enum. 5:340, 1850; Hook.f., Fl. Brit. India 6:291, 1892.

Perennial herbaceous climber, on humus rich soils and in forests. Flowers March-April, greenish. Alt. 1700-2800 m.

Vern. KRITZ

ORCHIDACEAE

Epipactis royleana Lindl. in Royle, Ill. Bot. Himal. 364, 1839; Hook.f., Fl. Brit. India 6:126, 1890.

Perennial herb, usually under forest shade. Flowers April-May, whitish. Alt. 1700-2300 m.

Orchis latifolia L., Sp. Pl. 941, 1753; Hook.f., l. c. 127.

Perennial herb, usually in damp places in forests. Flowers June-August, purple. Alt. 2400-2800 m.

Spiranthes lancea (Thunb. ex Thw.) Baker & V. Steenis, in Blumea 6:361, 1951; Santapau, in Journ. Bomb. Nat. Hist. Soc. 59 (1): 154, 1962; Raizada, Indian For. 94(6): 450, 1968.

S. australis Lindl., in Bot. Reg. 10, t. 823, 1824; Hook.f., l. c. 103.

Perennial herb, in marshy places. Flowers May-July, pale red. Alt. 1700-1800 m.

JUNCACEAE

Juncus articulatus L., Sp. Pl. 327, 1753; Kitamura, Fl. Afghan. 62, 1960.

J. lampocarpus Ehrh., Calam. n. 126 ex Davis in Trans. Linn. Soc. 10:13, 1810; Hook.f., Fl. Brit. India 6:395, 1893; Buchenan in Engl., Das Pflanzenreich Heft 25:216, 1906.

Perennial herb, usually in swamps, along borders of rice fields. Flowers June-September, greenish black. Alt. 1700-1800 m.

J. bufonius L., Sp. Pl. 328, 1753; Hook.f., l. c. 393.

Annual herb, usually in moist open places, marshes. Flowers April-July, greenish. Alt. 1700-2800 m.

J. glaucus Ehrh., Calam. n. 85 et Beitr. Naturk. 6:83, 1791; Hook.f., l. c. 393.

Perennial herb, usually along swampy places in forests. Flowers May-October, greenish. Alt. 1700-1800 m.

Luzula pallescens (Sw.) Besser, Enum. Pl. Wolh. Pod. etc. 15, 1822; Butcher, New Ill. Brit. Fl. 2:675, 1961.

Perennial herb, usually in moist shaded places, marshes. Flowers April-June, greenish brown. Alt. 1700-1800 m.

CYPERACEAE

Carex cernua Boo, Ill. 4:171, t. 578, 1867; Clarke in Hook.f., Fl. Brit. India 6:708, 1894.

Perennial herb, in marshy shaded places. Flowers April-May, greenish. Alt. 1700-1800 m.

C. foliosa D. Don, in Trans. Linn. Soc. 141, 327, 1825; Kükenth in Engl., Das Pflanzenreich Heft 101:163, 1909; Stewart, Bull. Bot. Surv. India 9(1-4): 153, 1967.

C. muricata var. *foliosa* Clarke in Hook.f., l. c. 703.

Perennial herb, in shaded damp places in forests. Flowers April-June, greenish. Alt. 1700-1900 m.

C. obscura Nees in Wight, Contrib. Bot. Ind. 126, 1834; Clarke in Hook. f., l. c. 734.

Perennial herb, in damp shaded places. Flowers April-May, brownish. Alt. 1700-1800 m.

C. psychrophila Nees in Wight, l. c. 127; Clarke in Hook.f., l. c. 732.

Perennial herb, usually in damp shaded places. Flowers April-June, brownish black. Alt. 1700-1800 m.

C. remota L., Amoen Acad. 4:293, 1759; Clarke in Hook.f., l. c. 706.

Perennial herb, under forest shade. Flowers May-July, greenish. Alt. 1700-2500 m.

C. setigera D. Don var. *schlagintweitiana* (Boeck) Kükenth in Engl., l. c. 419.

C. schlagintweitiana Boeck, Cyper. nov. 1:48, 1888; Clarke in Hook.f., l. c. 743.

Perennial tufted herb, fairly common on open savana slopes and open forests. Flowers April-June, chocolate brown. Alt. 1700-2800 m.

C. stenophylla Vahl., in Vetén. Akad. Handl. Stockh. 24:142, 1803; Clarke in Hook.f., l. c. 700.

Perennial herb, usually under forest shade. Flowers April-June, chocolate brown. Alt. 1700-1800 m.

Cyperus difformis L., Cent. Pl. 2:6, 1756; Clarke in Hook.f., l. c. 599.

Annual herb, along borders of rice fields. Flowers July-September, brownish. Alt. 1700-1900 m.

C. iria L., Sp. Pl. 45, 1753; Clarke in Hook.f., l. c. 606.

Annual herb, usually on borders of rice fields. Flowers July-September, yellowish green. Alt. 1700-1800 m.

C. globosus All. Fl. Pedem. Auctuar 49, 1789; Koyama in Kitamura, Fl. Afghan. 54, 1960; Kükenth in Engl. l. c. 101:352; Stewart, l. c. 157.

Pycneus capillaris Nees, in *Linnaea* 9:283, 1834; Clarke in Hook.f., l. c. 591.

Annual herb, along borders of rice fields. Flowers July-September, brownish. Alt. 1700-1900 m.

C. rotundus L., Sp. Pl. 67, 1753; Clarke in Hook. f., l. c. 614.

Perennial herb, usually in pastures, along stream sides, cultivated areas. Flowers June-October, chocolate brown. Alt. 1700-2100 m.

C. sanguinolentus Vahl., Enum. Pl. 2:351, 1806; Koyama in Kitamura, l. c. 55; Stewart, l. c. 158.

Pycneus sanguinolentus (Vahl.) Nees, l. c. 283; Clarke in Hook.f., l. c. 590.

Annual herb, along borders of rice fields. Flowers July-September, chocolate brown. Alt. 1700-1900 m.

C. serotinus Rottb., Progr. 18, 1772; Kükenth in Engl., l. c. 158; Stewart, l. c. 158.

Juncellus serotinus Clarke in Hook. f., l. c. 594.

Perennial herb, usually along rice fields. Flowers July-September, yellowish green. Alt. 1700-1900 m.

Eleocharis atropurpurea (Retz.) Presl., Rel. Haenk. 1:196, 1828; Clarke in Hook. f., l. c. 627.

Annual herb, usually along rice fields, rarer. Flowers July-September, chocolate brown. Alt. 1700-1800 m.

E. congesta D. Don, Prodr. Fl. Nep. 41, 1825; Clarke in Hook. f., l. c. 630.

Perennial herb, often locally common in marshes. Flowers April-July, chocolate brown. Alt. 1700-1900 m.

E. palustris (L.) Rb. Bx., Prodr. 224, 1860; Clarke in Hook.f., l. c. 624.

Perennial herb, in marshy places. Flowers April-June, chocolate brown. Alt. 1700-1800 m.

Fimbristylis dichotoma (L.) Vahl., l. c. 287; Stewart, l. c. 161.

F. diphylla (Retz.) Vahl. l. c. 289; Clarke in Hook. f., l. c. 636.

Perennial herb, usually common along rice fields. Flowers July-October, straw brown. Alt. 1700-1800 m.

F. podocarpa Nees in Wight, Contrib. 98, 1834; Clarke in Hook.f., l. c. 638.

Perennial herb, along rice fields. Flowers August-September, straw brown. Alt. 1700-1800 m. *New record for Kashmir.*

Kobresia laxa Nees in Wight, l. c. 119; Clarke in Hook.f., l. c. 698.

Perennial herb, usually in damp places in forests. Flowers April-June, brown. Alt. 1700-2000 m.

Scirpus juncoides Roxb., Fl. Ind. 1:216, 1820; Stewart, l.c. 161.
S. erectus sensu Clarke in Hook.f., l. c. 656 (non Poir.).

Perennial herb, usually common in rice fields, marshy places. Flowers June-September, brownish. Alt. 1700-1800 m.

S. setaceous L., Sp. Pl. 49, 1753; Clarke in Hook.f., l. c. 654.

Perennial herb, usually along marshy places, drains, damp situations. Flowers June-September, greenish black. Alt. 1700-2800 m.

GRAMINEAE

Aegilops tauschii Cosson, Not. Pl. Rar. Nouv. 2:69, 1849; Bor, Grasses India Burma & Ceylon 654, 1960; Stewart, Bull. Bot. Surv. India 9(1-4): 118, 1967.

Triticum aegilops P. Beauv., Agrost. 98, t. 3, 1812; Hook.f., Fl. Brit. India 7:367, 1897.

Annual herb, usually a weed of cultivation, also in wastelands. Flowers April-July, green. Alt. 1700-2000 m.

Agropyron semicostatum Nees ex Steud., Syn. Pl. Glum. 1:346, 1854; Hook.f., l. c. 369; Bor, l. c. 665.

Perennial herb, usually among scrubs on drier slopes. Flowers May-July, green. Alt. 1700-2200 m.

Agrostis canina L., Sp. Pl. 62, 1753; Bor, l. c. 386; Hook.f., l. c. 255.

Perennial herb, usually locally common on open slopes.

Flowers June-August, purplish green. Alt. 1700-3100 m.

A. pilosula Trin., in Mem. Sci. Petersb. Ser. 6, 6:372, 1841; Bor, l. c. 388.

Calamogrostis pilosula (Trin.) Hook. f., l. c. 263.

Perennial herb, on moister slopes. Flowers July-October, green. Alt. 1700-2500 m.

A. stolonifera L. Sp. Pl. 62, 1753; Bor, l. c. 390; Stewart, l. c. 119.

A. alba Auctt. (non L.); Hook. f., l. c. 254.

Perennial herb, in marshy places and along mountain drains. Flowers June-October, green. Alt. 1700-2700 m.

A. subaristata Aitch. et Hemsley, in Journ. Linn. Soc. Bot. 19:192, t. 29, 1881; Hook. f., l. c. 255; Bor, l. c. 390.

Perennial herb, on moister slopes. Flowers July-August, green. Alt. 1700-2300 m.

Alopecurus aequalis Sobol., Fl. Petrop. 16, 1799; Bor, l. c. 392; Stewart, l. c. 119.

A. aristulatus Michx., Fl. Bor. Amer. 1:43, 1803; Hook. f., l. c. 238.

Annual or biennial herb, usually in shallow standing waters, rice fields. Flowers April-May, green. Alt. 1700 m.

A. arundinaceous Poir. in Lamk., Encycl. Meth. Bot. 8:776, 1808; Hook. f., l. c. 238; Bor, l. c. 393; Stewart, l. c. 119.

Perennial herb, usually along roadsides, dry open slopes, rarer. Flowers April-June, silvery green. Alt. 1700-2100 m.

A. himalaicus Hook. f., l. c. 238; Bor, l. c. 393.

Perennial herb, in open pastures. Flowers July-September, silvery green. Alt. 3200-3800 m.

Arthraxon lancifolius (Trin.) Hockst., in Flora 39:188, 1856; Bor, l. c. 100; Stewart, l. c. 120.

Perennial herb, usually along borders of rice fields. Flowers July-September, purplish green. Alt. 1700-1900 m.

A. prionodes (Steud.) Dandy in Andrews, Fl. Pl. Sudan 3:399, 1956; Bor. l. c. 101; Stewart, l.c. 120.

Perennial herb, rocky areas, forest openings. Flowers June-September, purplish. Alt. 1700-2100 m.

Avena fatua L., Sp. Pl. 80, 1753; Hook. f., l. c. 275; Bor. l. c. 434.

Annual herb, usually in wastelands, forest openings. Flowers April-June, green. Alt. 1700-1900 m.

Bothriochloa pertusa (L.) Camus in Ann. Soc. Linn. Lyon, 1930, n.s. 76, 164, 193, 1930; Bor, l. c. 109; Stewart, l.c. 120.
Andropogon pertusus (L.) Willd., Sp. Pl. 4:922, 1806.

Perennial herb, usually common in pastures and wastelands. Flowers July-October, purplish. Alt. 1700-2300 m.

B. glabra (Roxb.) A. Camus, l. c. 174, 1931; Bor, l. c. 107; Stewart, l. c. 120.

Andropogon intermedius Hook. f., l. c. 175 (Pro parte).

Perennial herb, on dry savana slopes, in forest openings. Flowers July-September, pale purplish. Alt. 1800-2000 m.

Brachiaria eruciformis (Sm.) Griseb. in Ledeb., Fl. Ross. 4:469, 1853; Bor, l. c. 283; Stewart, l. c. 120.

Panicum isachne Roth. ex Roem. et Schult., Syst. Veg. 2:453, 1817.

Annual herb, usually along rice fields, cultivated areas. Flowers July-September, green. Alt. 1700-1800 m.

B. japonicus Thunb., Fl. Jap. 52, t. 11, 1784 var. **japonicus**; Bor. l. c. 455; Stewart, l. c. 121.

B. patulus Mert. et Kach in Reohl., Deutsch. Fl. 1:685, 1823; Hook. f., l. c. 361.

Annual herb, locally common in wastelands, forest openings. Flowers May-June, green. Alt. 1700-2100 m.

B. mollis L., Sp. Pl. ed. 2:112, 1762; Hook. f., l. c. 360; Bor, l. c. 455.

Annual herb, usually locally common along roadsides. Flowers May-July, green, Alt. 1700-1800 m.

Capillipedium parviflorum (R. Br.) Stapf in Prain, Fl. Trop. Afr. 9:169, 1917; Bor, l. c. 112; Stewart, l. c. 122.
Andropogon micranthus Kunth, Rev. Gram. 1:165, 1829; Hook. f., l. c. 178.

Perennial herb, locally common on borders of rice fields. Flowers July-September, purplish. Alt. 1700 m.

Chrysopogon echinulatus (Nees) W. Wats. in Atkins., Gaz. N.W. Ind. 392, 1882; Bor, l. c. 116; Stewart, l. c. 122.
Andropogon gryllus Hook. f., l. c. 187 (pro parte).

Perennial herb, fairly common on dry savana slopes and scrubby slopes. Flowers July-October, purplish. Alt. 1700-2300 m.

Cynodon dactylon (L.) Pers., Syn. Pl. 1:85, 1805; Hook. f., l. c. 288; Bor, l. c. 469.

Perennial herb, abundant in pastures and wastelands. Flowers May-November, green. Alt. 1700-2400 m.

Dactylis glomerata L., Sp. Pl. 71, 1753; Hook. f., l. c. 335; Bor, l. c. 335.

Perennial herb, usually in densely shaded forests. Flowers April-July, green. Alt. 1700-2700 m.

Digitaria adscendens (HBK) Henr., in Blumea 1:92, 1934; Bor, l. c. 298.

Annual herb, along damp situations. Flowers July-August, green. Alt. 1700 m.

New record for Kashmir.

D. granularis (Trin.) Henr., Monogr. Gen. Digitaria 302, 1950; Bor, l. c. 298.

Paspalum granulare Trin. ex Spreng. Neue Entdeck 2:47, 1821.

P. longiflorum Hook. f., l. c. 17.

Annual herb, along borders of rice fields, moist places. Flowers June-September, green. Alt. 1700-1800 m.

D. sanguinale (L.) Scop., Fl. Carn. ed. 2, 1:52, 1772; Bor, l. c. 304.

Paspalum sanguinale (L.) Lamk., Tab. Encycl. Meth. Bot. 1:176, 1791; Hook. f., l. c. 13.

Annual herb, usually along borders of rice fields. Flowers June-September, green. Alt. 1700-1900 m.

Echinochloa colonum Link., Hort. Berol. 2:209, 1833; Bor, l. c. 308; Stewart, l. c. 124.

Annual herb, a weed of rice fields, rarely in damp places. Flowers June-September, green. Alt. 1700-1900 m.

E. crusgalli (L.) P. Beauv., Ass. Agrost. 53, 161, 1812; Bor, l. c. 310; Stewart, l. c. 124.

Panicum crusgalli L., Sp. Pl. 56, 1753; Hook. f., l. c. 30.

Annual herb, a weed in rice fields. Flowers July-Sept., green. Alt. 1700-1900 m.

Eragrostis pilosa (L.) P. Beauv. Ass. Agrost. 71, 162, 175, 1812; Hook. f., l. c. 323; Bor. l. c. 512.

Annual herb, usually along roadsides. Flowers July-Sept., purplish. Alt. 1700-1900 m.

E. poaoides P. Beauv., Ess. Agrost. 162, 1812; Bor, l. c. 512; Stewart, l. c. 124.

E. minor Host., Gram. Austr. 4:15, 1809; Hook. f., l. c. 321.

Annual herb, usually common along roadsides, pathways. Flowers July-September, purplish. Alt. 1700-2000 m.

Hordeum leporinum Link., in Linnaea 9:133, 1835; Bor, l. c. 676; Stewart, l. c. 126.

Annual herb, usually along roadsides, wastelands. Flowers April-June, green. Alt. 1700-1800 m.

Koeleria cristata (L.) Pers., Syn. Pl. 1:97, 1805; Hook. f., l. c. 308; Bor, l. c. 444.

Perennial herb, on dry open and savana slopes, forest openings. Flowers April-May, green. Alt. 1700-2200 m.

Lolium temulentum L., Sp. Pl. 83, 1753; Hook. f., l. c. 364; Bor, l. c. 546.

Annual herb, usually in wastelands, forest openings. Flowers May-June, green. Alt. 1700-1800 m.

Lophochloa phleoides (Vill.) Reichb., Fl. Ger. Excurs. 42, 1830; Bor, l. c. 445; Stewart, l. c. 127.

Koeleria phleoides (Vill.) Pers. Syn. Pl. 1:97, 1805; Hook. f., l. c. 309.

Annual herb, usually in wastelands, forest openings. Flowers April-May, green. Alt. 1700-1800 m.

Muhlenbergia huegelii Trin., Mem. Acad. Sci. Petersb. Ser. 6, 6(2) : 293, 1841; Bor, l. c. 401; Stewart, l. c. 127.

M. viridissima Nees ex Steud., Syn. Pl. Glum. 1:178, 1854; Hook. f., l. c. 259.

Perennial herb, usually on savana slopes, sometimes along roadsides. Flowers July-September, silvery green. Alt. 2500 m.

Oryzopsis munroi Stapf ex Hook. f., l. c. 234; Bor, l. c. 640.

Perennial herb, on savana slopes, often also associated with *Stipa sibirica* patches in pastures. Flowers May-September, greenish purple. Alt. 1700-2300 m.

Pennisetum flaccidum Griseb., in Geott. Nachr. 86, 1868; Hook. f., l. c. 84; Bor, l. c. 344.

Perennial herb, usually along borders of rice fields, wastelands. Flowers May-October, purplish. Alt. 1700-2200 m.

P. orientale Rich. in Pers., Syn. Pl. 1:72, 1805; Hook. f., l. c. 86; Bor, l. c. 345.

Perennial herb, on dry rocky cliffs. Flowers yellowish green, May-November. Alt. 1700-2500 m.

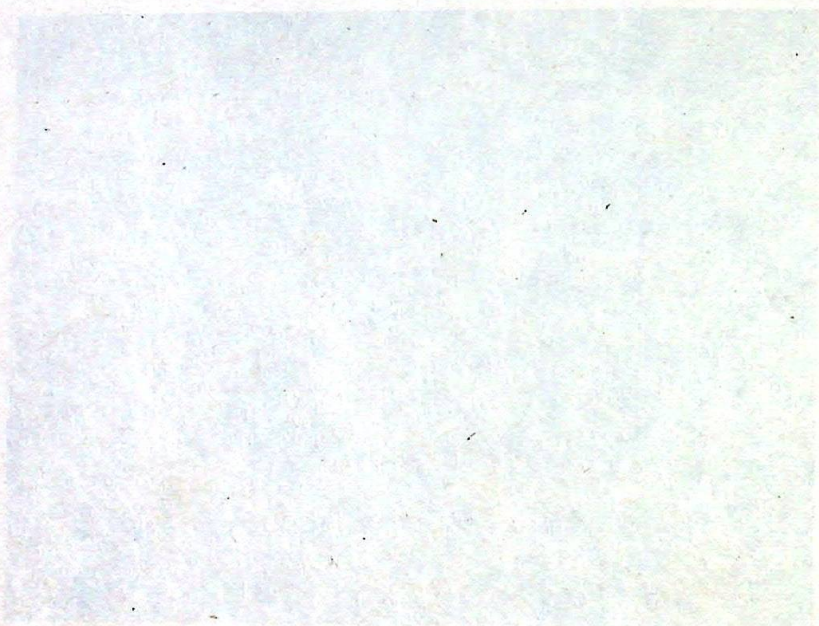
Phacelurus speciosus (Steud.) Hubbard, Kew Bull. 35, 1928; Bor, l. c. 199; Stewart, l. c. 129.

Rottboellia speciosa (Steud.) Hack. in DC., Monogr. Phan. 6:282, 1889; Hook. f., l. c. 152.

Perennial herb, usually among scrubs in forest openings, savanas. Flowers July-September, green. Alt. 1700-2300 m.



Plate 11. A. *Typha angustata* Bory and Chaub.
 B. *Dioscorea deltoidea* climbing on *Rubus niveus* Thunb.



Phalaris arundinacea L., Sp. Pl. 55, 1753; Hook. f., l. c. 221; Bor, l. c. 616.

Perennial herb, locally common in shallow waters. Flowers May-June, green. Alt. 1700 m.

Phleum alpinum L., Sp. Pl. 59, 1753; Hook. f., l. c. 236; Bor, l. c. 402.

Perennial herb, usually in pastures, more commonly along drains. Flowers August-September, blackish green. Alt. 2700-3700 m.

P. graecum Boiss. & Heldr., Diagn. Ser. 1, 13:42, 1853; Stewart, l. c. 129.

P. himalaicum Mez., in Fedde Rep. Sp. Nov. 17:293, 1921; Bor, l. c. 402.

P. arenarium Hook. f., l. c. 237 (non L.).

Annual herb, usually on moister disturbed slopes. Flowers May-June, green. Alt. 1800-2500 m.

P. paniculatum Huds., Fl. Angl. 23, 1762; Bor, l. c. 403, Stewart, l. c. 129.

P. asperum Jacq., Coll. 1:110, 1786; Hook.f., l. c. 237.

Annual herb, on dry disturbed slopes, in cultivated fields. Flowers May-June, green. Alt. 1700-2000 m.

Phragmites communis Trin., Fund. Agrost. 134, 1820; Hook.f., l. c. 303; Bor, l. c. 416.

Tall perennial herb, usually in shallow water ponds, also in damp places on slopes. Flowers July-October, purplish green. Alt. 1700-2200 m.

Poa annua L., Sp. Pl. 68, 1753; Hook.f., l. c. 345; Bor, l. c. 555.

Annual herb, usually common in shaded places. Flowers March-November, green. Alt. 1700-2300 m.

P. angustifolia L., Sp. Pl. 67, 1753; Bor, l. c. 555; Stewart, l. c. 129.

P. pratensis var. *angustifolia* (L.) Wahl. Fl. Lapp. 41, 1812; Hook.f., l. c. 340.

Perennial herb, in wastelands and forest openings. Flowers April-June, green. Alt. 1700-2100 m.

P. bulbosa L., Sp. Pl. 70, 1753; Hook.f., l. c. 338; Bor, l. c. 559.

Perennial herb, usually under forest shade, humus rich soils. Flowers April-May, purplish green. Alt. 1700-2600 m.

P. pratensis L., Sp. Pl. 67, 1753; Hook.f. Fl. Brit. India 7:339, 1897; Bor, l. c. 559.

Perennial herb, usually common in wastelands and forest openings in ravine. Alt. 1700-2100 m.

P. sterilis M. Bieb., Fl. Taur. Cauc. 1:62, 1808; Bor, l. c. 560; Stewart, l. c. 130.

P. attenuata Hook.f., l. c. 340.

Perennial herb, common on humus rich soils in forests and among scrubs. Flowers April-June, green. Alt. 1800-2900 m.

P. stewartiana Bor, Kew Bull. 185, 1951; Bor, Grasses India Burma and Ceylon 561, 1960.

Perennial herb, common on humus rich soils among scrubs and tall herbs. Flowers April-May, green. Alt. 1700-2600 m.

Polypogon fugax Nees ex Steud., Syn. Pl. Glum. 1:184, 1854; Bor, Grasses India Burma & Ceylon 403, 1960; Stewart, l. c. 130.

P. littoralis Sm. var. *higegaweri* Hook.f., l. c. 246.

Annual herb, usually along damp shaded places. Flowers June September, green. Alt. 1700-2300 m.

Sclerochloa dura (L.) P. Beauv., Ess. Agrost. 98, t. 19, f. 4, 1812; Hook.f., l. c. 335; Bor, l. c. 563.

Annual herb, in damp places, sometimes along roadsides. Flowers May-July, green. Alt. 1700 m.

Setaria glauca (L.) P. Beauv., Ess. Agrost. 51, 169, 178, 1812; Hook.f., l. c. 78; Bor, l. c. 360.

Annual herb, usually a weed of cultivation, also in waste-

lands, disturbed areas. Flowers August-October, green with yellowish bristles. Alt. 1700-1900 m.

S. viridis (L.) P. Beauv., l. c. 51, 171, 178, 1812; Hook.f., l. c. 80; Bor, l. c. 365.

Annual herb, usually a weed of cultivation, also in wastelands and along pathways. Flowers July-September, green with green or purple bristles. Alt. 1700-2100 m.

Sorghum halepense (L.) Pers., Syn. Pl. 1:101, 1805; Bor, l. c. 222; Stewart, l. c. 131.

Andropogon halepensis (L.) Brot. var. *genuinus* (Hack.) Stapf, in Hook.f., l. c. 183.

Perennial herb, usually a weed of cultivation, sometimes in wastelands. Flowers July-October, purplish. Alt. 1700-1900 m.

Stipa sibirica (L.) Lamk., Tab. Encycl. Bot. 1:158, 1791; Hook. f., l. c. 231; Bor, l. c. 646.

Perennial herb, very common in pastured areas. Flowers August-October, green. Alt. 1700-2800 m.

Vern. GUMIN GHAS

Themeda anathera (Nees) Hack. in DC., Monogr. Phan. 6:669, 1889; Bor, l. c. 249; Stewart, l. c. 132.

Anthistiria anathera Nees ex Steud., Syn. Pl. Glum. 1:402, 1855; Hook.f., l. c. 215.

Perennial herb, locally common on dry savana slopes and scrubby slopes. Flowers July-October, green. Alt. 1700-2500 m.

Tripogon purpurascens Duthie, in Ann. Roy. Bot. Gdn. Cal. 9:75, 1901; Bor, l. c. 522; Stewart, l. c. 132.

T. abyssinicus Hook. f., l. c. 287 (pro parte).

Perennial herb, in dry rocky areas and in fired areas. Flowers May-September, purplish. Alt. 1700-2400 m.

Vulpia myuros (L.) Gmel., Fl. Bad. 1:8, 1806; Bor, l. c. 564; Stewart, l. c. 133.

Festuca myuros L., Sp. Pl. 74, 1753; Hook. f., l. c. 356.

Annual herb, usually locally common in wastelands, disturbed slopes. Flowers April-June, green. Alt. 1700-2500 m.

PINACEAE

Abies pindrow (Royle) Spach. Hist. Phan. 11:423, 1842; Raizada, Indian For. 84(8): 468, 1958; Bor, Manual Indian For. Bot. 17, 1953.

A. webbiana Lindl. var. *pindrow* Brandis, For. Fl. 528, 1876; Hook. f., l. c. 5:654, 1890.

Evergreen tree, often forming dominant forests. Alt. 2400-3100 m.

Juniperus communis L., Sp. Pl. 1040, 1753; Hook.f., l. c. 646.

Evergreen shrub, isolated plants in pastures and forests, rarer. Alt. 1700-2400 m.

J. recurva Ham. in D. Don, Prodr. Fl. Nep. 55, 1825; Hook.f., l. c. 647.

Evergreen shrub, common on alpine slopes, often forming large patches. Alt. 3200-3700 m.

Picea smithiana (Wall.) Boiss., Fl. Or. 5:700, 1884; Raizada, l. c. 502; Kitamura, Fl. Afghan. 20, 1960,

P. morinda Link., Linnaea 15:522, 1841; Hook. f., l. c. 653.

Evergreen tree, distributed in silver fir forests. Alt. 2400-2900 m.

Pinus griffithii M'celland & Griffith, Notul. 4:17, 1854; Kitamura, Fl. Afghan. 21, 1960; Rehder, Man. Cult. Trees and Shrubs 38, 1940.

P. wallichiana Jackson, Kew Bull. 85, 1938; Raizada, Indian For. 84(8): 503, 1958.

P. excelsa Wall. ex Don in Lambert Descr. Gen. Pinus 2:5, t. 3, 1824 (non Lam.); Hook. f., l. c. 651.

Evergreen tree, common forming forests at lower altitudes. Alt. 1700-3000 m.

Vern. YARI

TAXACEAE

Taxus wallichiana Zucc., in Abhandl. Bayer. Acad. Classe Math. Phys. 3:805, t. 5, 1843; Kitamura, l. c. 20.

T. baccata L. ssp. *wallichiana* (Zucc.) Pilger in Engl. Das. Pflanzenreich Heft 18:112, 1903.

T. baccata sensu Hook. f., l. c. 648 (non L.).

Evergreen tree, isolated trees in forests. Alt. 2100-2900 m.
Vern. POSTUL

EQUISETACEAE

Equisetum debile Roxb., Vauch. Monogr. Prel. 376, 1822.

Perennial herb, usually in damp shaded places. Fruiting April. Alt. 1700-2600 m.

E. ramosissimum Desf., Fl. Atlant. 2:398.

Perennial herb, usually in dry places, among scrubs in forest openings. Fruiting July-October. Alt. 1700-2100 m.

SELAGINELLACEAE

Selaginella jacquemontii Spreng., Monogr. Lycopod. 2:194, 1849.

Perennial herb, often forming large patches on rocky cliffs. Largely vegetative. Alt. 1700-2300 m.

OPHIOGLOSSACEAE

Ophioglossum vulgatum L., Sp. Pl. 1062, 1753; Beddome, Handb. Ferns Brit. India 464, 1883.

Perennial herb, locally common in forests. Apikes April-June. Alt. 1700-2200 m.

OSMUNDACEAE

Osmunda claytoniana L., Sp. Pl. 1066, 1753; Beddome, l.c. 449.

Perennial herb, on open slopes, rarely in forests. Spores June-July. Alt. 2800-3300 m.

POLYPODIACEAE

Adiantum venustum Don, Prodr. Fl. Nep. 17, 1825; Beddome, l. c. 86.

Perennial herb, usually in rock crevices, forest slopes. Spores June-November. Alt. 1700-2200 m.

Asplenium adiantum-niger L., Sp. Pl. 1081, 1753; Beddome, l. c. 156.

Perennial herb, on humus rich scrubby slopes, rock crevices. Spores May-October. Alt. 1700-2800 m.

A. septentrionale (L.) Hoff., Deuts. Fl. 2:12, 1795; Beddome, l. c. 145.

Perennial herb, in crevices of rocks. Spores May-October. Alt. 1700-2500 m.

A. trichomanes L., Sp. Pl. 1080, 1753; Beddome, l. c. 143.

Perennial herb, usually common on humus rich soils, in rock crevices. Spores June-October. Alt. 1700-2900 m.

Ceterach officinarum DC., in Lam. & DC., Fl. Fr. 2:566, 1805; Stewart, Bull. Torrey Bot. Club 72(4): 418, 1945.

Hemidictyum ceterach (L.) Beddome, l. c. 194.

Perennial herb, in crevices of rocks. Spores April-June. Alt. 1700-2100 m.

Dryopteris thelypteris (L.) A. Gray, Man. 630, 1848; Stewart, l. c. 407.

Lastrea thelypteris Desv., in Mem. Soc. Linn. 6:257; Beddome, l. c. 241.

Perennial herb, usually along drains, damp places. Spores July-October. Alt. 1700-2400 m.

Pteridium aquilinum (L.) Kuhn.; Stewart, l. c. 422.

Pteris aquilina L., Sp. Pl. 1533, 1753; Beddome, l. c. 115.

Perennial herb, often locally common in forest openings. Spores June-October. Alt. 1700-2400 m.

Pteris cretica L., Mant. 130, 1767; Stewart, l. c. 422; Beddome, l. c. 106.

Perennial herb, usually among scrubs, rarer. Spores July-October. Alt. 1700-1900 m.

MARSILEACEAE

Marsilea quadrifolia L., Sp. Pl. 1099, 1753.

Perennial herb, usually in rice: swamps, ponds. Spores July-November. Alt. 1700-1800 m.

SALVINIACEAE

Salvinia natans (L.) All., Fl. Pedem. 2:289, 1785.

Floating annual, usually in rice swamps, rarer. Spores July-October. Alt. 1700 m.

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APPENDIX

ETHNOBOTANY OF KASHMIRIS

P. KACHROO AND (MRS) IQBAL MAHMUDA NAHVI

Early history and culture

The mountain barriers have assured in the past such a unique position of isolation to Kashmir that it does not find a place in the earliest truly historical notices of the northwest India, except for a certain reference to it in classical Ptolemy's Geography (see below). However, more modern writers have divided the history of Kashmiris in seven periods : namely, those of Hindu kings, the Kashmir Muslims, the Moghuls, the Pathans, the Sikhs, the Dogra, and the pre-Hindu rule. "There certainly are records in stone of a history before the Hindu kings.....of that most terrible earthquake which swallowed Sandimat Nagar during the reign of Sundar Sena between 2082 and 2041 B. C.Sandiman who reigned in Kashmir from 2629 to 2564 B.C..... 'and King Ramdeva who built one of the famous Martand temples in 3005-2936 B.C.' " (Grevis, 1954) :

Notices in literature about old Kashmir, a secluded alpine land (c. f. in part from Stein, 1891)

A. Foreign notices

1. Alexander's invasion, 327 B.C.....non notice.
2. Ptolemy's Geography, 1775.....exact reference, Kaspeiria, "below the source of the Bidaspes (Vitasta) and of Sandabal (Chandrabhaga) and of Idris (Iravati)".
3. Hekataios, 549-486 B.C.....city of Kaspatriyros.
4. Herodotos, ca 450 B. C. somewhere near Gandhara (Peshawar).
5. Chinese notice, 541 A.D..... Indian envoy reaches China;
630 A.D..... Hiuen Tsiang, Buddhist pilgrim from China.

6. Muslim notice, 8th century.....ignorant.

—Muslim conquest of north India.....Kashmir still isolated and safe.

—Arab geographers, no notice, just mention.

—Alberuni, 1017-30 A.D.....no personal knowledge, collected information through Kashmiri scholars. (The farthest Muslims went was to Rajouri).

B. Indigenous (within India)

1. Panini's Grammar*.....only mention of Kashmir and Kashmiris.

2. The Mahabhartā, 1500 B.C.....vague mention of Kashmir (the land) and its rulers.

3. Purāna, 322 B.C.....just a northern nation.

4. Varahamira, ca 500 A.D.....Kashmir in northwestern region, only location given.

According to Stein (*l.c.*), Ptolemy's *Kaspeiria* is an accurate transcript of the form of the region's name which phonetically is clearly an intermediate stage between the Sanskrit *Kasmira* and the modern Kashmiri form *Kasir*. Coming to near to the earlier Prakrit form *Kasvira*, *Kaspeiria* is as close a rendering of this form as Greek writing permitted. A far earlier reference to Kashmir in classical literature as *Kaspatryros* is that of Herodotos who mentioned that, "the city of *Kaspatryros* as the place at which the expedition under the *Seylax* of *Koryanda*, sent by *Darius* to explore the course of the *Indus*, embarked". He distinctly places this city in the *Pektejan* land which was to the north of other Indians, apparently bordering on the *Baktrian* territory. We believe with Stein in that there is lack of proper understanding of etymology which is responsible for deriving the name of this valley from *Kashyapura* after *Rsi*. *Kashyap*. "The philological impossibility of deriving *Kasmira* from *Kashyapura* need scarcely be specially indicated.....though it has

*Panini was the first grammarian who collected all the dialectical forms of the spoken languages of his age, and composed a systematic Sanskrit grammar known as *Ashṭadhyāyee* (500 B.C.). He also dealt with Vedic grammar.

found its way into works of authorities like Ritter, Lassen, Humboldt; and has hence been reproduced by recent workers. The name *Kasmira* in its original Sanskrit has been used as the sole designation of the country throughout its known history. It has been uniformly applied both by the inhabitants and by foreigners, we can trace back its continued use throughout an unbroken chain of documents for more than 23 centuries" (Stein, *l. c.*). In the language of the inhabitants the name is now pronounced as *Kasir*. This form is direct phonetic derivative of the *Kasmira* with regular loss of the final vowel and assimilation of *m* to the preceding sibilant. But linguistic science does not furnish any clue to the origin of the name nor even analysis of its formation.

One thing is certain: the cool air of Kashmir, the northern aspect of its scenery and products have at all times exercised a powerful charm over those visitors, who themselves born in colder climes, have come to this valley from the heat and dust of the plains on the northern dry and frosty plateaus. (Asoka conquered Kashmir in 250 B.C., Tartar chiefs invaded the valley in about 200 B.C. and there was large scale Scythian immigration in 6th century A.D.... . c. f. Grevis, 1954)*.

The indirect effect of these stay overs was bound to result in plant introduction and introduction of novelty in plant and animal nomenclature. However, this communion was limited only with the northern and north-western neighbours, as Kashmir was virtually closed to the Indian plains; thus it was never seriously threatened even when Islam overspread the whole northern India. This also speaks for lack of mention of Kashmir in early classical histories of India.

Yet in the prehistoric past, "we have no reason to assume that the Himalayas or the Pir Panjal Range were a barrier to the migration of Paleolithic or even Neolithic man." In fact, "Both northern India and China must have direct contacts

*During Asoka's period the Kashmiri architecture and sculpture were greatly influenced by those of Egypt and Greece; and the valley became Buddhist. It was in 525 A.D. that the valley went back to Brahminism and in 725-750 A.D. the Kashmir empire under King Lalitaditya spread from Central Asia to Kanauj (India) (Grevis, 1954). It was in late 13th century that Islam spread into the valley, but "the early Muslims in their hearts were Hindus" (Lawrence, 1895).

across the Himalayas since the dawn of human existence, and the passes over these mountains probably mark some of the most ancient routes trodden by man. If, therefore, signs of Stone Age man were even to be found, say, on the Zoji-la itself, such a discovery would only be in accordance with expectation" (Sahni, 1936). de Terra (1932) has mentioned of a discovery of an outpost of "Indus civilisation in the valley of Kashmir not far from the route connecting Srinagar with Zoji-la". "We may hopefully look for an extension of this ancient culture marking the end of the Neolithic period, even across the Zoji-la" (Sahni, *l.c.*).

Due to this geographical isolation local tradition has remained undisturbed, and this has considerable bearing on etymology of plant and animal names, and for the fact that many of the Aryan creeds and customs still persist. In fact according to Kalhana (c.f. Stein, *l.c.*), the popular language in early Kashmir was not Sanskrit, but an *Apabhrama* dialect derived from it and this has gradually developed into the modern Kashmiri. In fact linguistically Kashmiri holds a unique position (Grierson, 1899, 1906) and should be considered separate from the Indo-Aryan languages. Grierson further stated that "Kashmiri is a mixed language, having its base a language of the Dard group of the Pisacha family allied to Shina.....its phonetic, its accidence, its syntax, its prosody,—is Pisacha, it must be classed as such, and not as a Sanskritic form of speech" (Grierson, 1906). According to Chatterji (1963) the language, "in its basic stratum belong to the Dardic Section of Aryan or Indo-Iranian. Possibly one section of the Aryans who came to India before 1,000 B.C. and who spoke dialects very much alike the language of *Rig-Veda* but with certain special characteristics (which later gave rise to the Dardic branch of Aryan) became established in the valley of Kashmir.....Kashmiri language is a result of a very large over-laying of a Dardic base with Indo-Aryan elements".

At present a number of dialects are current in the valley (Fig. 1). None of the *Pahari* (mountainous) dialects in written, but, "there are written characters used for Dogri, Kashmiri, and Tibetan. They are derived from the Devnagri or Shastri, the

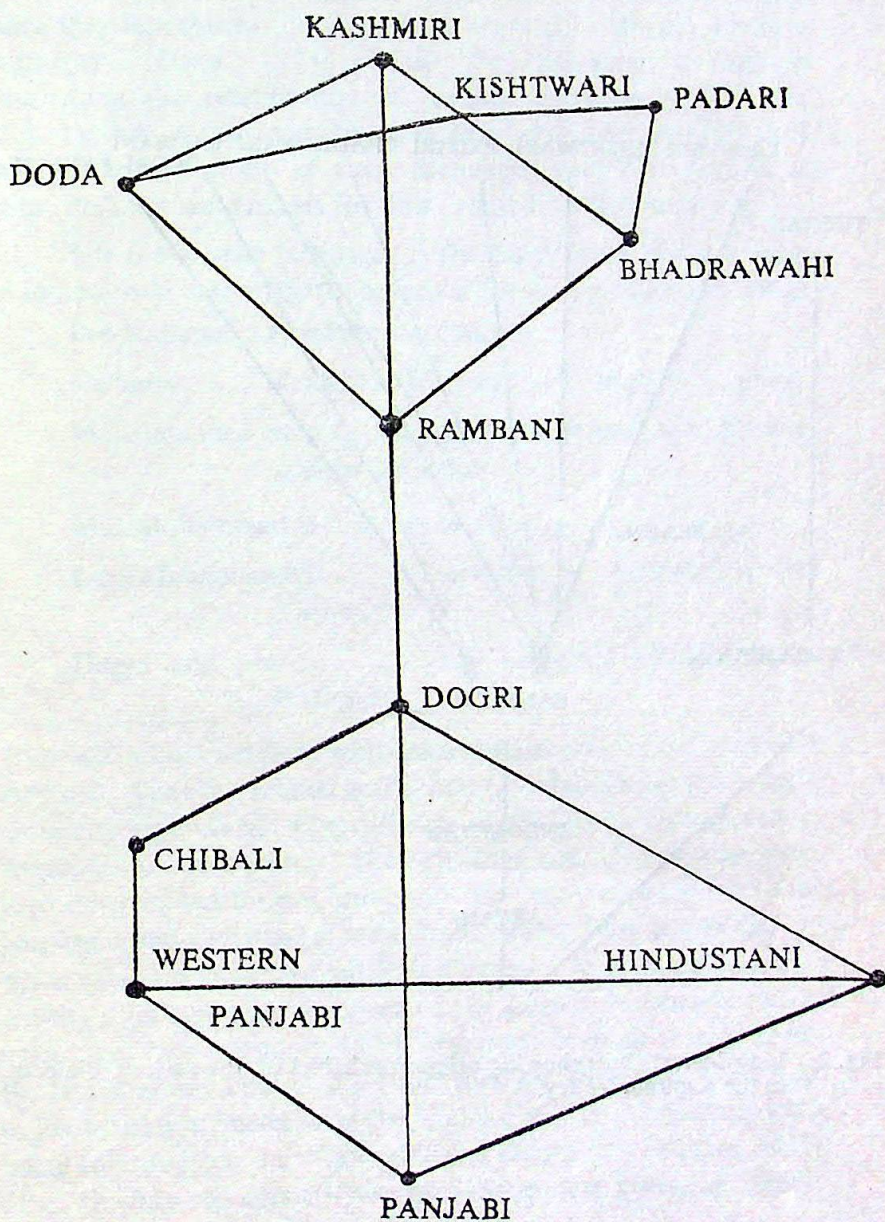


Fig. 1. Relationships of the local dialects in the Jammu and Kashmir State. (After Drew, 1876).

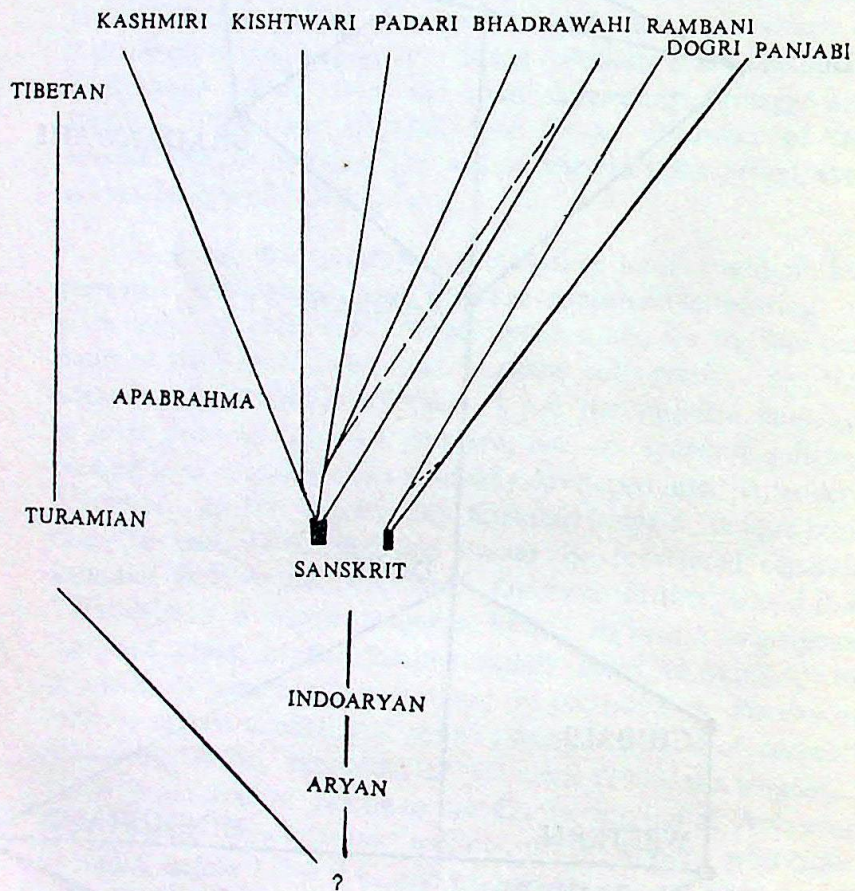


Fig. 2. Lineal chart showing origin (probable) of the various dialects in the Kashmir Valley.

characters in which Sanskrit is written...But all these alphabets which are founded on Sanskrit are disliked by Mohammads, since they fear this to be the vehicle by which Hindu idolatry is taught" (Drew, 1876). Drew (*l.c.*) has given a diagram illustrating the relationships of certain languages of this area (Fig. 1); this should not be mistaken for a lineological chart! After a critical study of these languages, we have arrived at some definite conclusions in this regard as shown in Fig. 2.

The use of state languages in the valley from earliest times is summarised below (partly based on Stein, *l. c.*; Bamzai, 1962):

Pre-Kalhana....Apabhrama dialect.

Kalhana..... Sanskrit official and sole literary language.

Mohammads early.....Sanskrit official and sole literary,
spoken Kashmiri.

Mid-Mohammadsas in above.

Late-Mohammads Intrusion of Persian, spoken
Kashmiri.

Dogra and present.....Urdu (Persian) official, spoken
Kashmiri.

Kashmiris together with other inhabitants of the valley are Aryans. They are related to Paharis (inhabitants of the middle mountain regions) but very different from Dards (inhabitants of Astor, Gilgit, and Dah). The Tibetans are a Turanian race. Kashmiris in fact form a branch of the race which brought the languages and customs of the Indo-Aryan type into India; but when their actual settlement in the country took place and from which direction they immigrated is rather debatable. However, the valley was ruled by Brahmins from very early times, the last Brahmin king of Kashmir lost his throne in 1320 A.D. to his Muslim minister; and the Muslim rule continued till 1820, being followed by the Sikh and the Dogra rule (Grevis, 1954), till 1947 when the country became independent (Bamzai, 1962).

Plants in religious and social rites

The early Kashmiris were all Brahmins. Their religious rituals were of two types : non-vedic and pro-vedic. The non-vedic

rites were based (and still are) on *Trantrya* and *Agama*. These are linked with the Mohen-ju-Daro rituals but are now confined only to Kashmir. The vedic rites are based on *Loagaksha-Padatee* which in nature are pro-vedic and contain certain features which do not find a place in other systems of India and may have been pre- or even post-vedic. These have been divided into three ceremonies : those connected with *yagnopavit*, marriage, and death are described fully by Loagaksha in *Kathak Garh Sutra* (Shastri, 1938).

Desmostachya cynosuroides was used uniformly in religious ceremonies. It was collected on the new moon in Aug.-Sept. (*dharbi amavas*). A few leaves (7-10 cm long) were twisted into a ring which was worn in the fourth finger of right hand while performing religious rites connected with marriage, death and other purely religious functions. A few shoots (7-15 cm long) were used to sprinkle sacred water over places meant to be sanctified, may be the platform over which religious fire was lit, a dead body, cremation site, entry into a new house, etc. A girdle of this grass was put around the neck of a bride in marriage ceremony.

Crocus sativus also featured prominently in ceremonies connected with religious and social functions. The coffin of a dead body was sprinkled with saffron dye, using *Desmostachya cynosuroides* shoots for this purpose. It was used as *tika* (mark on forehead), sprinkled over yugart bowls sent to a bridegroom's house on the first conception of the bride, being an announcement about the affair. Saffron was also used as a spice on rare occasions.

The use of barley is as old as the fire worshipping, and it formed an important ingredient of the floral and fruit offerings during fire (worship) rituals. Barley straw (now replaced by paddy straw) used to be laid under the dead body till it was removed for cremation (or burial). Rice grains appear to have entered the religious scene at a much later stage and continue to be used at subsidiary functions like offering a *puja*. There is reason to believe that it was used introduced by the local clergy (Brahmins). An image of god (*bata bror*) was made of cooked rice mixed with butter, yugart, *Sesamum* seed, etc. and worship-

ped at *shrada* (death anniversary) ceremony by Brahmins of Tantrik order. *Sesamum indicum* oil was used as an offering to god, the oil in a lamp being used in obsequial rites for deceased father or other relation.

The flowering shoot of a non-edible *Mentha*, emitting a pleasant scent was used as a floral offering with lotus, and it is used so locally only in the valley for this purpose. Dried leaves of *Imperata cylindrica* were used in religious ceremonies; and fresh leaves of *Skimmia laureola* which contain aromatic oil, have a pleasant scent, were used as incense, particularly while worshipping god Shiva. The rootstock of *Morina longifolia*, *M. coulteriana* and *Koelzella pabularia* (roots are medicine, Santapau and Henry, 1973) were burnt as incense. Extract from the roots of *Jurinea macrocephala* is still used as incense (Maheshwari and Singh, 1965). *Peganum harmala* seed used universally as incense on important social functions entered the cultural life in early 11th century; and young ladies used to scent their bodies with the smoke of the seed, the latter was burnt in a *kangri* (the local handy charcoal stove) and allowed to remain within the *feran* (gown like garment worn by gents and ladies in good old days, even now!) so as to soak the body with scent. As elsewhere, the henna powder was used to smear over palms and soles. Gents and ladies, young and old, used it on the eve of marriages. It was also used on the soles to give a cooling effect.

Betula bark was used to perform the ceremony of lustration after a mother was bathed on the sixth day after a child birth in which wisps of birch bark were lightened and waved over the heads of the mother and the child, and then extinguished in a jar of water. Seeds of *Amaranthus tricolor*, considered a heating food, were eaten on fast days. The rhizome of *Acorus calamus* was auspicious on the New Years Day. It was placed over a specially prepared rice grain bowl and seen the first thing in the morning.

About 30 cm long twigs of mulberry were used to comb hair of a bride a day prior to wedding. It was after the actual wedding ceremony that the bride could use the proper comb.

Such twigs were also used in the marriage ceremony which used to be performed around a fire.

Art and crafts

Kashmiris were celebrated in the old days for their skill in art manufactures. Nearly all excel as weavers and homespun cloth worn by the villagers in the winter is still wonderful. But he has changed little, e.g., 'the carpenter still uses the age old kind of hammer, half adze (*tur*) and a chisel (*turats*) but with just these two tools can execute any work required. But he has great inborn talent for floral and geometric plan' (Lawrence, 1895).

The leaves of *Typha angustata* were used to weave mats, of which two types were common, the circular (*tsaingich*) and rectangular (*wagu*). A special type of footwear (*pulharo*) was also made of iris leaves and it was specially worn by the gentry and the bride. An inferior type made of paddy straw was used by the commoner. Another type of footwear (*khrao*) was made of wood and used during winter to wade through mud. Another unique innovation of Kashmiris was the *kangri*, still in use (the origin of *kangri* is still unknown). It is a small fire pot with a cane frame; that of ordinary type was woven of twigs of *Parrotia jacquemontiana*, and the finer one of *Indigo*; the inner container being of baked mud, about 15 cm wide. The *kangri* has entered the local fabric of social life rather too closely. It formed a part of dowry, a gift on the eve of *shivratri* (a religious function to commemorate lord Shiva's marriage) to the bride by her father, and a part of death rites. These rites still continue.

Wood of *Euonymus (hol)* was used to make pen boxes and for tablets which were used in lieu of slates in schools. Twigs of *Cotoneaster acuminata* and of *C. frigida* were used for basket making and also twig bridges. Walking sticks and aspen stocks were made from *C. bacillaris*. *Lagenaria siceraria* was a good material for cupping.

There was hardly any article of kitchenware which was not made of wood. Wood of *Aesculus indica* and *Abies pindrow* was used for making water troughs and as filling for boats;

fruits were eaten; that of *Acer caesium* in carving and for making bowls, plates and ladles; that of *Cotoneaster* and *Parratiopsis* in axe handles, that of *Prunus* variously : *P. cornuta* for tools; that of *Carissa spinarum* for spoons and similar cutlery and combs, (the fruits were eaten). Ploughs were made of wood of mulberry, ash and apple; and pestle from hawthorn. *Buxus wallichiana* timber was used for engraving musical instruments, small boxes, and combs. Dried rind of walnut fruits was used to paint doors and windows.

Toilet

The bark of walnut and its fruit rind (fresh and dried) were used to clean teeth. Cuttings of fresh twigs were used to brush hair by ladies. *Corydalis falconeri*, a medicinal grass, was used as (hair) tonic and was supposed to render hair thick, fragrant, soft, and long. Rhizome of *Cyperus rotundus* was powdered and used as perfume, roots of *Euonymus thomsoniana* as detergent for hair by ladies, and those of *Althaea* spp. for the same purpose after rinsing hair with yugart. A grandmother states that incense of seeds of *Peganum harmala* was used as scent on nuptial night when the body was soaked in smoke. The tubers of *Dioscorea deltoidea* were used as soap to cleanse wool and its rhizome and that of *Peganum harmala* to kill lice. *Origanum vulgare* was used in perfumery, soap making, and as a condiment (Maheshwari and Singh, l.c.).

Medicine

Heliotropium eichwaldi was used for a number of ailments from boils, ulcers to bites of snakes and mad dogs. *Macrotomia benthamii* was curative in diseases of tongue, throat and fever; and *Pedicularis* spp. to stop splitting of blood (Nandkarni, 1954); the dried leaves and flowering tops which were used in cough, cold and for rheumatism form the source of a drug now (Maheshwari and Singh l.c.).

Urtica sp. was used as stomachic and diuretic; *Descurainaea sophia* and *Linum usitatissimum* poultice for external use in ulcers; rhizome of *Cyperus rotundus* and bark of *Ulmus wallichiana* and related species in cutaneous diseases; seeds and decoction of *Solanum nigrum* as antiperiodic, tubers of *Dioscorea*

deltoidea as diuretic; seed powder of *Sisymbrium irio* in eye sour; *Dolichos biflorus* and *D. conflorus* in renal ulcers; decoction of *Parnassia palustris* as remedy in nervous troubles; *Geranium wallichianum* in toothache; *Portulaca oleracea* in colds, also in inflammatory diseases—being considered cool and dry; poultice of *Mentha* was good for sword wounds and sores together with that of the leaves of *Hedera helix*; leaves of *Salix* spp. (cooling remedy) were made into a yellow dyestuff, for this bark and wood of *Datisca cannabina* was also used, both being cure against fevers; leaves of *Salix* were also used locally in warm water on feet to remove fatigue.

Mallotus philippensis was used as vermifuge; *Descurainia sophia* eaten to kill worms; *Artemisia maritima* and *A. vulgaris* as vermicide; decoction of leaves and root in treatment of round worms, the rind against sores; decoction of leaves of *Adiantum venustum* and fresh leaves of *Limnanthemum nymphaeoides* in headaches (its plants were fed to cattle to increase yield of milk); poultice from stems of *Polygonum* spp. in saddle sores; roots of *Euphorbia thomsoniana*, rhizome of *Podophyllum hexandrum*, *Polygonum dumetorum*, berries of *Hedera helix*, dried seeds of *Ipomoea nil* as purgative; and *Lactuca serriola* and *Lithospermum arvense* (?) as sedative. The leaves and roots were made into a poultice for application to ulcers and wounds (Kirtikar and Basu, 1935).

Seeds of *Verbascum thapsus* were used as fish poison. According to Chopra *et al.* (1965) the whole plant may possess piscicidal properties. Pammel (1911, *A Manual of Poisonous Plants*) further records that it is not very poisonous to livestock. We have never observed cattle or goats browsing on it. Roots of *Aconitum chasmanthum* and *A. deinorrhizum*, and runners of *Hydrocotyle javanica* (also used as substitute for *Centella asiatica*, both have the same vernacular names, Anon., 1959) were used to poison arrows for killing wild life and fish, respectively; roots of *Anemone obtusiloba* as blistering agents; those of *Caltha palustris* are still considered poisonous in the neighbouring Pakistan (district of Hazara); *Stipa tartarica*, *Rhododendron camplanatum* as poison, roots of *Inula royleana* to kill lice, fleas, and ticks, dried powder of leaves of *Cynanchum arnottianum* against muggets

infesting wounds of cattle, horses and sheep. *Oxytropis mollis* was considered poisonous but its actual use could not be ascertained. However, Siddique and Basha (in Anon., 1966) have reported that imported merino rams and horses grazing on these plants were nearly wiped out, though the local sheep either refused to eat it or were immune to it. The related species *O. microphylla* found in Ladakh is browsed by yaks and sheep. *Menyanthes trifoliata*, restricted to Kashmir in India, was perhaps used in skin affections. It is regarded as an emergency food in the U.S.S.R., and its leaves used as substitute for hops in Germany and Sweden (Uphof, 1959). It is also used as substitute for tea and has a number of medicinal properties (Kirtikar and Basu, l. c.).

Leaves and rootstock of *Polygonum amphibium* (also cooling) and decoction of roots of *Carduus nutans* were used as blood purifiers; *Chenopodium botrys* and *C. ambrosioides* in asthma; the former is also used as substitute for the latter. In France and Europe, *C. botrys* is reported to be used for catarrh and humoral asthma (Kirtikar and Basu, l. c.). *Chenopodium ambrosioides* var. *anthelminticum* is not eaten by animals and fatal cases of poisoning are recorded (Chopra et. al., l. c.). *Polygonum bistorta* was used as astringent in profuse menses, also in colitis and as expectorant; tuberous roots of *Paeonia emodi* in uterine diseases; *Erigeron canadensis* in intestinal disorders, (it is used in Africa for ringworm and eczema, Anon., 1952); *Polygonum alpinum* and *P. viviparum* in dysentery of cattle; roots of *Plumbago indica* and leaves and flower heads of *Achillea millefolium* as carminative, decoction of *Macrotomia benthami* in heart ailments; rhizome of *Calamintha clinopodium* as cardiac tonic; (*C. umbrosa* also occurs in Kashmir and is not easily distinguishable from it. It yields a light yellow essential oil, Moudgill, J. Soc. Chem. Ind., Lond. 43:163, 1924); *Cardamine pratensis*, *C. impatiens* and fusion of leaves of *C. clinopodium* as stimulant (also in rheumatism); and decoction of *Taraxacum officinale* leaves was fed to convalescent mothers.

Wild food plants

Barbarea spp, *Paspalum scrobiculatum*, tap root of *Codonopsis ovata*, *Sorghum halepense*, *Marsilea quadrifolia*, rhizome

of *Typha angustata* and *Nymphaea alba*, and *Ulmus wallichiana* (this was fatal as well) were used as famine foods. Fruits of *Cucumis sativus*, *Cydonia oblonga*, *Coriaria nepalensis*, *Rubus* spp, wild rosaceous plants; tubers of *Orthosiphon rubicundus*, leaves and spines of *Cousinia thomsoni* when young and tender; fern *Aspidium* (dried); stems of number of *Polygonums* boiled with milk, seeds of *Papaver somniferum* (as sweetballs) were eaten. Fruits of *Elaeagnus angustifolia*, *Rhus punjabensis* (leaves also used in tanning) and several species of *Ribes* were eaten (Mahe-shwari and Singh, l. c.).

Rhizome of *Nelumbo nucifera*, petiole of *Limnanthemum nymphaeoides*, *Crambe cordifolia* root (the plant is also used as a cure for itch, Santapau and Henry, l. c.), leaves of *Malva parviflora* (national vegetable), tender leaves of *Medicago sativa*; species of *Lagenaria*, *Luffa*; *Plantago lanceolata* (also supposed preserve eye sight), *Polygonum alpinum*, *Phytolacca acinosa* (tender leaves), *Ophioglossum vulgatum*, *Dipsacus* spp. were eaten as vegetables. *Limnanthemum nymphaeoides* is used as fodder now. Kirtikar and Basu (l. c.) state that it increases the flow of milk of cows feeding on it; and that fresh leaves are useful for periodic headaches. A warm decoction of the rhizome of *Ophioglossum vulgatum* is used by the Sutos of southern Africa as a lotion for boils (Wren, 1956). In Indonesia *O. reticulatum* (perhaps this species also occurs in Kashmir) is eaten as salad and as vegetable, alone or mixed with other vegetables (Burkill, 1935). *Oxalis acetosella* and *O. corniculata* were eaten raw or added to cooked vegetable preparations to give subacid taste. Other wild plants used as flavouring materials for cooking colouring food-stuffs were *Onosma hispidum kashmiricum*, *Crocus sativus*, *Origanum vulgare* (leaves and tops cut prior to blooming) and *Cymbopogon citratus*. The roots of *Onosma hispidum* and *Macrotomia perennis* constitute the *Rattanjot* of the Punjab and northwestern Himalayas (Kirtikar and Basu, l. c.). *Polygonum bistorta* was used in stews and soups and *Oxyria digyna* in preparation of *chitneys*. Seeds of *Carum carvi* and *C. bulbocastanum* were used as spice. In Pakistan (Quetta) seeds of the latter are even now used to protect warm clothes and skins against insect attack (Kirtikar and Basu, l. c.). *Chenopodium bli-*

tum and *Leucas cephalotes* (also used in colds and coughs) were used as pot herbs and *L. lanata* as a vegetable. Tender shoots of the latter after frying are a remedy for cough in Assam (Anon. 1962). *Origanum vulgare* is now the source of Origanum Oil. However, the Oil of Origanum in trade is really Thyme Oil (*Thymus vulgaris*) and it is also confused with marjoram (*Majorana hortensis*) oil (Anon., 1966).

The habit of eating dried vegetables and fruit was rampant and has come down to the present day; and no sort of vegetable or fruit was excluded in this respect. There was need for it as the valley remained sealed from mid-December to mid-April in winter under snow. The system of drying was simple.

Housing and Household

Aesculus indica was used in boat building. For construction of huts/houses *Cedrus deodara* and *Pinus wallichiana* were mainly used; besides *Fraxinus excelsior* (Maheshwari and Singh, l. c.), *Marlea begonifolia*, *Morus alba* and *Prunus cornuta*. Most of these are still used as timber and *Marlea begonifolia* is reported to be used for furniture in Vietnam and for axe handles in Indonesia (Gamble, 1922).

Young shoots of *Ulmus wallichiana* and related species were used to make strong ropes; and ashes of burnt twigs formed a dye and also fire wood. *Rubia cordifolia* and *Mallotus philippensis* also gave a dye, that from *Leonurus cardiaca* is dark olive green in colour. This plant is still used as a stomachic and diaphoretic (Maheshwari and Singh, l.c.). *Geranium nepalense* was used as a substitute for *M. philippensis* which is known now in the trade as Kamala Powder/Dye and used in dyeing of silk and wool. Recently the oil extracted from its seeds is found to be a good substitute for tung oil (Anon., 1962). The roots of *Jurinea macrocephala* and *Morina longifolia* (also the whole plant) were used as incense; the reed cotton, *Phragmites communis*, in plastering walls, the grey colour made up of mud mixed with the reed was applied to the inner walls of the house like white wash. *Lycopus europaeus* plants and a yellow dye stuff from bark and wood of *Datisca cannabina* were used to dye wool, and fruits of *Dipsacus fullonum* in woollen industry for raising

the nap (Maheshwari and Singh, l. c.); dried leaves of *Xanthium strumarium*; leaves and stock of *Polygonum amphibium* for tanning leather; wood of *Pinus wallichiana* and *P. roxburghii* splintered and made into torches used in night.

Plants in folklore

The early Kashmiri poets have left vivid detailed of topography of the land and their surroundings. The first and most hopeful of the Kashmiri-authors-cum-poets in Ksemendra and his work *Samayamatrka* which is an original poem. The next poet of importance is Bilhana and his historical poem is entitled *Vikramankadevacarita*. Mankha, a contemporary of Kalhana deserves third place for his remarkable description of Kashmir and Srinagar in his *Srikanthacarita*.

APPENDIX I

List of Plants used by early Kashmiris

In the following table, plants are listed alphabetically. Other plant species and higher taxa are mentioned in the next. Nomenclature of the species is after the Wealth of India (Anon., 1959-1966), Maheshwari and Singh (1965), and Santapau and Henry (1973). The following symbols are used in the table :

+, use has been mentioned by informants or in literature specifically for this region.

(+), use has been noted either generally for this region, or specifically for adjoining (geographical) areas.

Plant species	Food 1	Techno- logy 2	Medicine 3	Recrea- tion 4	Religion & belief 5
<i>Abies pindrow</i> Royle					
<i>Abutilon theophrasti</i> Medic.		+			
<i>Acer caesium</i> Wall.			+		
<i>Achillea millefolium</i> Linn.		+			
<i>Aconitum chasmanthum</i> Stapf ex Holmes			+		
<i>A. dienorrhizum</i> Stapf			+		

	1	2	3	4	5
<i>Acorus calamus</i> Linn.			+		
<i>Adhatoda vasica</i> Nees.					+
<i>Adiantum capillus-veneris</i> Linn.			+		
<i>A. venustum</i> D. Don			+		
<i>Aesculus indica</i> Colebr. ex Wall.		+			
<i>Agaricus</i> spp.	+				
<i>Allium sativum</i> Linn.	+				
<i>Althaea officinalis</i> Linn.				+	
<i>Alnus nitida</i> Endl.		+			
<i>Amaranthus tricolor</i> Linn.	+				
<i>Anagallis arvensis</i> Linn.			+		
<i>A. arvensis</i> var. <i>coerulea</i> Gren & Godr			+		
<i>Anemone obtusiloba</i> D. Don			+		
<i>Artemisia absinthium</i> Linn.			+		
<i>A. maritima</i> Linn.			+		
<i>A. vulgaris</i> Linn.			+		
<i>Asparagus filicinus</i> Buch.-Ham.			+		
<i>Aster diplostephioides</i> Benth.			+		
<i>Berberis aristata</i> DC.	+		+		
<i>B. lycium</i> Royle			+		
<i>Beta vulgaris</i> Linn.	+				
<i>Brassica campestris</i> Linn.	+				
<i>B. juncea</i> (L.) Czern. & Cross.	+				
<i>B. oleracea</i> Linn. var. <i>acephala</i> DC.	+				
<i>Betula utilis</i> D. Don		+			
<i>Buxus wallichiana</i> Baill.	+	+			
<i>Calamintha clinopodium</i> Benth.			+		
<i>Caltha palustris</i> Linn.			+		
<i>Cannabis sativa</i> Linn.			+		
<i>Capsella bursa-pastoris</i> (L.) Moench	+		(+)		
<i>Cardamine pratensis</i> Linn.			+		
<i>Carex nubigena</i> D. Don			+		
<i>Carissa spinarum</i> Linn.		+			
<i>Carpesium abrotanoides</i> Linn.			+		
<i>Carum carvi</i> Linn.	+				
<i>C. bulbocastanum</i> W. Koch			(+)		

	1	2	3	4	5
<i>Carduus nutans</i> Linn.			+		
<i>Cedrus deodara</i> Loud.		+			
<i>Cedrella toona</i> Roxb. ex Rottl. & Willd.		+			
<i>Celtis australis</i> Linn.		+			
<i>Centella asiatica</i> (L.) Urban			+		
<i>Chenopodium ambrosioides</i> Linn. var.					
<i>anthelminticum</i> (L.) Gray	+				
<i>C. blitum</i> Hook. f.	+				
<i>Cicer arietinum</i> Linn.	+				
<i>Cichorium intybus</i> Linn.	+				
<i>Cicuta virosa</i> Linn.			+		
<i>Cimicifuga foetida</i> Linn.			(+)		
<i>Citrullus vulgaris</i> Schrad ex Eckl. & Zeyh.	+				
<i>Clerodendrum indicum</i> (L.) Kuntze			(+)		
<i>Codonopsis ovata</i> Benth.	+				
<i>Colchicum luteum</i> Baker			+		
<i>Conium maculatum</i> Linn.			+		
<i>Coriandrum sativum</i> Linn.	+				
<i>Coriaria nepalensis</i> Wall.	+				
<i>Cornus sanguinea</i> Linn.			+		
<i>Corylus colurna</i> Linn.			+		
<i>Corydalis falconeri</i> Hk. f. & T.				+	
<i>Cotinus coggygria</i> Scop.	+				
<i>Cotoneaster acuminata</i> Lindl.		+			
<i>C. bacillaris</i> Wall. ex Lindl.		+			
<i>C. frigida</i> Wall. ex Lindl.		+			
<i>C. microphylla</i> Wall. ex Lindl.		+			
<i>C. nummularia</i> Fisch. & Mey		+			
<i>Cotula anthemoides</i> Linn.	+				
<i>Crambe cordifolia</i> Stev.	+				
<i>Crocus sativus</i> Linn.					+
<i>Cucumis melo</i> Linn.	+				
<i>Cuscuta reflexa</i> Roxb.			+		
<i>Cydonia oblonga</i> Mill.	+				
<i>Cymbopogon citratus</i> (DC.) Stapf	+				
<i>C. martinii</i> (Roxb.) Wats.	+				

	1	2	3	4	5
<i>Cynanchum arnottianum</i> Wight			+		
<i>Cyperus rotundus</i> Linn.			+	+	
<i>Daphne oleoides</i> Schreb.			+		
<i>Datisca cannabina</i> Linn.			+		
<i>Datura stramonium</i> Linn.			+		
<i>Daucus carota</i> Linn.	+				
<i>Desmostachya bipinnata</i> (L.) Stapf					+
<i>Descurainaea sophia</i> (L.) Webb ex Prantl			+		
<i>Digitaria marginata</i> Link	+				
<i>Dioscorea deltoidea</i> Wall.			+	+	
<i>Dipsacus inermis</i> Wall.	+				
<i>D. fullonum</i> Linn.		+			
<i>Echinochloa colonum</i> (L.) Link	+				
<i>Edwardsia mollis</i> Royle	+				
<i>Elaeagnus angustifolia</i> Linn.	+		+		
<i>E. umbellata</i> Thunb.	+				
<i>Erigeron canadensis</i> Linn.			+		
<i>Eryngium caeruleum</i> Bieb.		+			
<i>Euonymus fimbriata</i> Wall.		+			
<i>Euphorbia peplus</i> Linn.			(+)		
<i>E. thomsoniana</i> Boiss.			+		
<i>Euryale ferox</i> Salisb.	+				
<i>Ferula narthex</i> Boiss.			(+)		
<i>Fragaria vesca</i> Linn.	+				
<i>Fraxinus hookeri</i> Wenz.			+		
<i>F. xanthoxyloides</i> Wall.			+		
<i>Gentiana kurroo</i> Royle.			(+)		
<i>Geranium nepalense</i> Sweet			+		
<i>G. wallichianum</i> D. Don			+		
<i>Gymnosporia montana</i> (Roth.) Benth.					+
<i>Hedera helix</i> C.B. Clarke			+		
<i>Heliotropium eichwaldi</i> Steud.			+		
<i>Heracleum cashemiricum</i> C.B. Clarke		(+)			
<i>Herniaria hirsuta</i> Linn.			(+)		
<i>Hieracium umbellatum</i> Linn.			(+)		
<i>H. virosum</i> Pall.			(+)		

	1	2	3	4	5
<i>H. vulgatum</i> (Fries) Almq.			(+)		
<i>Hierochloe laxa</i> R. Br.		(+)			
<i>Hyoscyamus niger</i> Linn.			+		
<i>Hypericum perforatum</i> Linn.			+		
<i>Impatiens balsamina</i> Linn.			+		
<i>I. glandulifera</i> Royle		(+)			
<i>I. parviflora</i> DC.			(+)		
<i>Imperata cylindrica</i> (L.) P. Beauv.					+
<i>Inula racemosa</i> Hk. f.					+
<i>I. royleana</i> DC.			+		+
<i>Ipomoea nil</i> (L.) Roth			+		
<i>Iris ensata</i> Thunb.				+	
<i>I. florentia</i> Linn.					+
<i>I. pseudoacorus</i> Linn.		+			
<i>Jasminum officinale</i> Linn.				+	
<i>J. officinale</i> var. <i>grandiflorum</i> (L.) Kabuski				+	
<i>J. humile</i> Linn.				+	
<i>Juglans regia</i> Linn.		+			
<i>Juncus inflexus</i> Linn.		+			
<i>Juniperus communis</i> Linn.		+			
<i>Jurinea macrocephala</i> Benth.		+			
<i>Koelzella pabularia</i> (Lindl.) Hiroe				+	
<i>Lactuca serriola</i> Linn.			+		
<i>L. tatarica</i> C.A. Mey var. <i>tibetica</i> Hk. f.			(+)		
<i>Lagenaria siceraria</i> (Mol.) Standl.		+			
<i>Lawsonia inermis</i> Linn.					+
<i>Leonurus cardiaca</i> Linn.		+	+		
<i>Lepidium latifolium</i> Linn.	+				
<i>Leucas cephalotes</i> Spreng.			+		
<i>Limnanthemum nymphaeoides</i> Link	+				
<i>Linum usitatissimum</i> Linn.			+		+
<i>Lonicera quinquelocularis</i> Hardw.			+		
<i>L. webbiana</i> Wall.		+			
<i>Luffa acutangula</i> (L.) Roxb.	+				
<i>Lycopus europaeus</i> Linn.		+			
<i>Macrotomia benthamii</i> DC.			+		

	1	2	3	4	5
<i>Mallotus philippensis</i> Muell.-Arg.			+		
<i>Malva parviflora</i> Linn.	+			+	
<i>M. sylvestris</i> Linn.			+		
<i>Marlea begonifolia</i> Roxb.		+			
<i>Marsilea quadrifolia</i> Linn.	+				
<i>Meconopsis aculeata</i> Royle	+				
<i>Megacarpaea polyandra</i> Benth.	+				
<i>Menyanthes trifoliata</i> Linn.			+		
<i>Mentha arvensis</i> Linn.			+		
<i>Mirabilis jalapa</i> Linn.	+		+		
<i>Momordica charantia</i> Linn.	+				
<i>Morchella esculenta</i> L. ex Gr.	+				
<i>Morina coulteriana</i> Royle		+			
<i>M. longifolia</i> Wall.					+
<i>Morus alba</i> Linn.	+	+			
<i>M. nigra</i> Linn.	+	+			
<i>Myrsine africana</i> Linn.		+			
<i>Nardostachys jatamansi</i> DC.			+		
<i>Nelumbo nucifera</i> Gaertn.	+				
<i>Nymphaea alba</i> Linn.	+				
<i>Onosma bracteatum</i> Wall.		+			
<i>O. hispidum</i> Wall. ex D. Don	+				
<i>Ophioglossum vulgare</i> Linn.	+				
<i>O. vulgatum</i> Linn.	+				
<i>Origanum vulgare</i> Linn.	+	+			
<i>Orthosiphon rubicundus</i> Benth.	+				
<i>Oryza sativa</i> Linn.	+				+
<i>Oxalis corniculata</i> Linn.	+		+		
<i>Oxyria digyna</i> (Linn.) Hill.	+				
<i>Oxytropis mollis</i> Royle ex Benth.			+		
<i>Paeonia emodi</i> Wall. ex Royle			+		
<i>Panicum antidotale</i> Retz.	+				
<i>P. miliaceum</i> Linn.	+				
<i>Papaver somniferum</i> Linn.	+		+		
<i>P. nudicaule</i> Linn.			(+)		

	1	2	3	4	5
<i>P. rhoeas</i> Linn.			(+)		
<i>Parnassia palustris</i> Linn.			+		
<i>Parrotiopsis jacquemontiana</i> (Decne) Rehd.		+			
<i>Paspalum scrobiculatum</i> Linn.	+				
<i>Pedicularis pectinata</i> Wall.			+		
<i>P. siphonantha</i> D. Don.					
<i>Peganum harmala</i> Linn.				+	+
<i>Phragmites communis</i> Trin		+			
<i>Phytolacca acinosa</i> Roxb.			(+?)		
<i>Physochlaina praealta</i> (D. Don) Miers.			+		
<i>Picea smithiana</i> (Wall.) Boiss.		+			
<i>Picrorhiza kurrooa</i> Royle ex. Benth.					
<i>Pinus wallichiana</i> A.B. Jackson		+			
<i>Plantago lanceolata</i> Linn.	+				
<i>P. major</i> Linn.	+		(+)		
<i>Plectranthus rugosus</i> Wall.	+				
<i>Plumbago indica</i> Linn.			+		
<i>Podophyllum hexandrum</i> Royle			+		
<i>Polygonum alpinum</i> All.	+				
<i>P. amplexicaule</i> D. Don.			+		
<i>P. aviculare</i> Linn.	(+)				
<i>P. bistorta</i> Linn.	+		+		
<i>P. convolvulus</i> Linn.			+		
<i>P. dumetorum</i> Linn.			+		
<i>P. fagopyrum</i> Linn.	+				
<i>P. lapathifolium</i> Linn.					
<i>P. orientale</i> Linn.	+				
<i>P. persicaria</i> Linn.	+				
<i>P. polystachyum</i> Wall. ex Meissn.					
<i>P. rumicifolium</i> Royle ex Bab.	+				
<i>P. runcinatum</i> Buch-Ham. ex D. Don	+				
<i>P. sibiricum</i> Laxm.	+				
<i>P. virginianum</i> Linn.				+	
<i>P. viviparum</i> Linn.				+	
<i>Populus alba</i> Linn.		+			

	1	2	3	4	5
<i>Portulaca oleracea</i> Linn.	+		+		
<i>Prunus amygdalus</i> Batsch	+	+			
<i>P. armeniaca</i> Linn.	+	+			
<i>P. cerasus</i> Linn.	+				
<i>P. cornuta</i> (Wall. ex Royle) Steud.		+			
<i>P. domestica</i> Linn.	+				
<i>Punica granatum</i> Linn.	+	+		+	
<i>Quercus incana</i> Roxb.		+	+		
<i>Randia spinosa</i> Poir			+		
<i>Rhamnus virgata</i> Roxb.		+			
<i>Rhododendron campanulatum</i> D. Don.			+		
<i>Rubia cordifolia</i> Linn.		+			
<i>Rubus lasiocarpus</i> Sm.	+				
<i>R. fruticosus</i> Linn.	+				
<i>R. pedunculatus</i> D. Don	+				
<i>R. rotundifolius</i> Royle	+				
<i>R. saxatilis</i> Linn.	+				
<i>Rumex acetosella</i> Linn.	+				
<i>Sambucus wightiana</i> Wall.			(+)		
<i>Saussurea lappa</i> C.B. Clarke			+		
<i>Scirpus articulatus</i> Linn.		+			
<i>Setaria italica</i> (L.) P. Beauv.		+			
<i>Sesamum indicum</i> Linn.	+				+
<i>Sisymbrium irio</i> Linn.			+		
<i>Skimmia laureola</i> Sieb & Zucc. ex Walp.					+
<i>Solanum nigrum</i> Linn.			+		
<i>Sorghum halepense</i> (L.) Pers.	+				
<i>Spiraea vestita</i> Wall.			+		
<i>Stipa tartarica</i> Linn.			(+)		
<i>Taxus baccata</i> Linn.		+			
<i>Taraxacum officinale</i> Weber.	+		+		+
<i>Trapa bispinosa</i> Roxb.	+				
<i>Tribulus terrestris</i> Linn.			(+)		
<i>Trigonella foenum-graecum</i> Linn.	+				
<i>Trifolium repens</i> Linn.	+				

	1	2	3	4	5
<i>Typha angustata</i> Bary & Chaub.	+	+			
<i>Ulmus wallichiana</i> Planch.	+	+	+		
<i>Verbascum thapsus</i> Linn.			(+)		
<i>Veronica antheilmintica</i> Willd.			+		
<i>V. beccabunga</i> Linn.	+				
<i>Viburnum continifolium</i> Don.			+		
<i>V. stellulatum</i> Wall.	+		+		
<i>V. foetens</i> Decne	+		+		
<i>Vicia faba</i> Linn.	+				
<i>Viscum album</i> Linn.			(+)		
<i>Vitis vinifera</i> Linn.	+				
<i>Wrightia zeylanica</i> R. Br.		+			
<i>Xanthium strumarium</i> Linn.		+			
<i>Zizyphus vulgaris</i> Lamk.	+				

APPENDIX II

*Some general botanical names and phrases, sayings, in the
Kashmiri language of early days.*

kath, wood.

hakh, cabbage.

posh, flower.

wudar, plateau.

anchar, pickles.

ag, knot of wood.

agazuin, fire wood with many knots.

agur, sandal wood.

aha-kij, pin of plough.

ala-kulis tula-kul, mulberry tree for a pumpkin vine, lengthening out a small affair by turning truth into falsehood and v. v. wor, vegetable garden, kitchen garden.

ali-ali-khasun, to mount like a pumpkin vine.

ali-ti-shapth bale-ti-shapth, cursing a person whether he is offering a small service or doing anything of great difficulty and value.

anema, rice water, rice gruel.

ashud, medicine, especially for eyes.

ot (aanth), stone of fruit.

tsunth-hyuh, quince coloured, pallid as a result of illness.

banga wudawunu, to take away entirely and destroy. (*bang*, cannabis).

banga wuthunu, to be entirely consumed.

banga deli watas, commencing any work with improper materials.

banga yar, boon companion.

banga mainz natschun, to labour in vain.

hurzul, special kind of walnut with thin sheel.

bosu, chaff and other refuse of grain, broken husk.

bata, boiled rice.

bata way pyon, poverty to fall, destitution by the death of the bread winner of a family to happen.

batas pyonu, to fall on someone for support.

bata phali pothar, pot love, cupboard love.

bata-bata lagun, starvation to occur.

babr, herb.

bach, single long dried branch of a tree or creeper, esp. willow.

batakh lyut, clover.

butin, wild vegetable creeper.

beli khasun, to put in proper order, to set a crowd of people in rows. (*beli*, creeper).

chang, cone of fir tree.

chontu, broom of twigs.

chand, drug made of opium and smoked in a pipe.

dandasa, bark of walnut tree.

khapari phamb tsanun, greatly increase another's slight pain by some petty action. (*phamb*, cotton fibre).

kong turu ishunun, to express approval, to select on account of charm or worthiness. (*kong*, *Crocus sativus*).

kyowu kadun, to spend a long time over completing any work. (*kyowu*, *Sagittaria sagitifolia*).

nari, reed.

pinga ladin haikas, do nothing. (*pinga*, millet).

til yunu, to be exhausted in searching for something hidden or destroyed. (*til*, oil of *Sesamum indicum*).

triphal, medicine composed of three myrobalans.

totu, cotton seed.

The terms, etc., are arranged after Grierson (1932).

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15	24	Jacg	Jacq.
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	19	Dc.	DC.
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	21	Chamb.	Camb.
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	16	heading SIRINAGAR	SRINAGAR
	17	suotheast	southeast
	32	New Thir	New Thid
52	12	scruby	woody
	17	Add asterisk after 'range'	
	30	scruby	scrub
	33	scrubs	shrubs
	Bottom	Add footnote—*I, 0-10 cm; II, 10-50 cm; III, 50 cm-2 m; IV, 2-5 m; V, 5-8 m; VI, 8-25 m.	
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